ILLUSTRATIONS

OF

INDIAN BOTANY;

OR

FIGURES ILLUSTRATIVE OF EACH

OF THE

NATURAL ORDERS OF INDIAN PLANTS,

DESCRIBED IN THE AUTHOR'S

PRODROMUS FLORÆ PENINSULÆ INDIÆ ORIENTALIS ;

WITH OBSERVATIONS, ON THEIR BOTANICAL RELATIONS, ECONOMICAL USES, AND MEDICINAL PROPERTIES ; INCLUDING DESCRIPTIONS OF RECENTLY DISCOVERED OR IMPERFECTLY KNOWN PLANTS.

BY

ROBERT WIGHT, M. D., F. L. S., &c.

MEMBER OF THE IMP. ACAD. NATURÆ CURIOSORUM,

SURGEON ON THE MADRAS ESTABLISHMENT.

VOL. I.

MADRAS:

PUBLISHED BY J. B. PHAROAH

FOR THE AUTHOR

MDCCCXL.

TO

THE RIGHT HONORABLE JOHN LORD ELPHINSTONE,

GOVERNOR OF THE PRESIDENCY

OF

FORT ST. GEORGE:

THIS ATTEMPT

TO EXTEND AND IMPROVE,

BY MEANS OF COLOURED FIGURES

AND

BOTANICAL OBSERVATIONS,

THE KNOWLEDGE OF THE VEGETABLE PRODUCTS OF INDIA,

ESPECIALLY OF THOSE TERRITORIES

ENTRUSTED TO HIS LORDSHIP'S GOVERNMENT,

IS MOST RESPECTFULLY DEDICATED

BY HIS LORDSHIP'S OBLIGED AND

OBEDIENT HUMBLE SERVANT,

ROBERT WIGHT.

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PREFACE.

In the Preface to the Prodromus Floræ Peninsulæ Indiæ Orientalis, will be found a brief historical sketch of the rise, progress and present state of Indian Botany. From that sketch it will be perceived that until the publication of that volume, every work since the time of Linnæus, with the exception of DeCandolle's *Systema Vegetabilium* and *Prodromus Systematis*, treating of Indian plants, was arranged according to the Linnæan sexual or artificial system. It has naturally followed that nearly all those who had devoted their leisure to the investigation of Indian plants have adopted that system, and find the study of them according to their natural affinities often exceedingly difficult if not actually irksome, even though the advantages of the latter over the former method so greatly preponderate as scarcely to admit of any comparison being instituted between the two. Instigated, therefore, partly by a long cherished wish to promote the extension of Botanical pursuits by diffusing a knowledge of species, partly by the desire of lessening to others the difficulties which beset my own path when passing from the one method of study to the other; but principally in the hope of being able to show that for the attainment of a correct and comprehensive knowledge of the properties and uses of plants, whether as food, medicine, or in the arts, a much more direct and certain method is, through an enlarged and philosophical acquaintance with their natural affinities than by the most laborious, but empirical, search for individual properties when entered upon without any such guide as the knowledge of affinities supplies to our researches. To elucidate these affinities and at the same time to furnish the Indian Botanist with the means of identifying species this work and its Companion, the " Figures of Indian Plants" were undertaken, and even at their present early stage the author has reason to believe with much advantage towards the accomplishment of this design.

According to the natural arrangement, all plants, whether of a province, a kingdom, or of the whole world, agreeing in certain ascertained peculiarities of structure, taken not from one set of organs only, but from every part of the plant commencing with the root and ascending to the perfect seed, are grouped together as one order or family under a name derived either from a prominent genus of the group or from some striking peculiarity of the order (*Ranunculaceae* from Ranunculus: *Cruciferae* from their cruciate flowers: *Leguminosae* from the leguminous fruit, &c.). Such groups if correctly associated according to their affinities, that is organic structure and physiological peculiarities, would, it was presumed, be found to participate in the kind and qualities of secreted products which result from the operations of organic life.

In this anticipation the philosophical investigator of nature has not been disappointed, for, so constantly does the fact agree with the theory that it is now known, except in rare instances,

plants referable to different families will not graft on each other, apparently, because the juices elaborated in different families of plants, though growing side by side, in the same soil, are so different in their qualities that those of the one are unfit to nourish a branch taken from the other: while on the other hand two plants of the same natural family, however much the soils in which they respectively grow may differ, can generally, be readily grafted on each other. From the same cause, the action, namely, of organization on secretion, we find in a great many instances identical properties common to whole families of plants. Acrimony predominates throughout the *Ranunculaceae* and *Cruciferae:* narcotism is the characteristic of *Papaveraceae* and *Solanaceae: Apocyneae* are generally poisonous and some of the species most virulently so: astringency is common to nearly all the arboreous *Mimoseae* as well as to many of the *Caesalpineae,* it equally predominates in *Terminaliae,* and the whole of the genus *Quercus* is pre-eminently marked by that property. The *Cucurbitaceae, Convolvulaceae* and *Euphorbiaceae* are equally distinguished by properties the very reverse, the action of many species of each of these orders being violently drastic. The fruit of *Rosaceae* and seed of *Leguminosae* on the contrary, are so universally wholesome that it may be laid down as a general rule almost without exceptions, that they may be safely partaken of whenever they are met with.

These few examples will suffice to show how vastly the study of properties is facilitated by an acquaintance with natural affinities, and will, I trust, at the same time serve to remove an objection which I have more than once hard urged against this work, that it did not sufficiently treat of Medical Botany. This objection could only be raised by those who did not sufficiently consider that its object was to establish principles on a scientific basis, as being the true way to attain the object sought for. There is no royal road to science, and until the medical man studies the principles of Botany as a science, he need never expect through an inspection of plates or specimens of medical plants to become a medical Botanist. But with only an elementary knowledge of Botany, such for example as a perfect knowledge of the structure of the flower and fruit, an acquisition not generally of very difficult attainment, the case is widely altered, since any one who had advanced so far in the knowledge of the elements of the science may easily make himself master of the characters of a few species of an order, and then he can generally trace its relations with nearly allied orders or even recognize some of them from family likeness alone. Having ascertained the order of the plant under examination the subsequent steps leading to the attainment of a comprehensive knowledge of its name, history and properties, are comparatively easy; and not of it only but of the whole order. It is true, that to acquire a thorough acquaintance with an order, frequently requires the student to examine and carefully compare several, but every plant so examined facilitates subsequent researches and lessens the difficulty of the next step, that namely of making out the genus. But even without going so far, having once determined the order of a plant, we are in possession of a fund of information, since, but little further trouble is required to make ourselves acquainted with all that is yet recorded respecting that order, and to ascertain whether any applications we have learned are still unknown to science. The natural method in short gives both precision and extension to any enquiries we may undertake respecting plants, whether considered with reference to organic structure and its modifications, the products of organic life in connection with structure, or the applications of these products to the comforts and conveniences of life; and thereby to the advancement of civilization among men. The difficulties to be surmounted at the outset of the study are no doubt often great, those namely,

of determining the order of a plant when it departs from the normal structure of the order to which it belongs; but even then, a futile search is not unattended with advantage, as the examination puts us in possession of much useful information which will materially assist our future research should we be necessitated to turn to the artificial system to find its name.

Should we on the contrary commence our examination with the artificial sexual system the first step, that of determining the class and order of a plant is the easiest, but that done, it often happens that nothing is learned, for, should the specimen under examination have a stamen or style more or less than the regular number, and nothing is more common among tropical plants, we look in vain in the class or order where according to our specimen it should be found, and when found, still that system conveys no collateral information regarding the relations of the plant or of the nature of the properties with which it may be endowed.

In drawing these comparisons it is not my wish unduly to exalt the one at the expense of the other, for in truth they are so very different that it is impossible to compare them, they both have their advantages and disadvantages, and in the present state of the science are both necessary, I certainly think however the preponderance of good is greatly in favour of the natural method. In thus giving the preference to that system which enables the student, who has made considerable progress in its study, to look over a large collection of plants, not one of which he had ever seen before, and readily refer probably as many as 19 out of every 20 to its proper natural order, from family likeness alone, I am far from as yet wishing to see the other altogether exploded, since by it we are often enabled quickly to determine abnormal plants that we could not so easily have done by the other; and in such cases, I still occasionally find the advantage of having formerly become familiar with the Linnæan system. Though to this extent I approve of it, I could not recommend it for general use, as its natural tendency is to contract our ideas by concentrating our attention too exclusively on one set of organs and confining our enquiries to the investigation of the names of species only, in place of, as is the case with the other, expanding them with the growth of our knowledge by extending our researches, from the examination of species to the investigation of masses in all their bearings.

While for these cogent reasons, we are in the present advanced state of the science gradually permitting that once celebrated system to drop into oblivion, we must not forget how much Botany is indebted to it for its present advancement. The extent of these obligations can only be justly appreciated by comparing the Botanical works of its great author with those of his immediate predecessors, not one of the plants described by whom can now be made out from their descriptions unaided by some collateral circumstance or by plates and too often, even with these aids, they are still unknown. Immediately on its introduction into practice order supplanted disorder, arrangement and method succeeded and dispersed the previous confusion and perflexity as light disperses the darkness. From this hour materials accumulated with unprecedented rapidity and have continued to do so to such an extent, that the catalogue of known plants which on the most liberal computation, did not at Linnæus' death exceed 12,000, is now but little if at all short of 100,000 species. To this increase the natural method owes much of its present admirable precision, as without such a mass of materials innumerable breaks in the chain of affinities must still have existed, marring both its beauty and usefulness. We may thence I think fairly conclude, that the sexual system of Botany, however defective in scientific precision and comprehensiveness of design, was yet of incalculable benefit to the science, the im-

pulse which its beauty and simplicity communicated, calling thousands of enthusiastic votaries into the field, by whose joint labours was collected the vast mass of valuable materials of which the more philosophical natural method was constructed, leaving altogether out of consideration, the justly admired nomenclature and precision of language appropriated to the description of plants introduced by its author, the universally acknowledged father of modern Botany, Linnæus.

Having I trust satisfactorily shown that the essential difference between the two systems lies in the tendency of the one to contract our ideas by attaching an undue value to the knowledge of species, while that of the other is to elevate and expand the mind by imparting a knowledge of and leading to the contemplation of masses, I believe I have said all that can be required in support of my preference of the natural system and of the propriety of my first determination to publish a flora of this portion of India arranged according to that method. The same reasoning equally establishes the propriety of my entering on the present work, explanatory of the principles of that system and showing its application to the grouping in masses of the knowledge which has for ages been accumulating as detached observations, but which, until thus concentrated was of difficult access and, when obtained, only applicable to the species to which it originally appertained in place of as now, by affording so many points of comparison or known quantities, enabling us to deduce useful applications, of hitherto unknown plants, simply on the ground of their structural relationship or affinity in the system of nature to others, the qualities of which are well known.

That many anomalies nay positive contradictions occur in our present groups is undeniable, but it is equally certain that many of these are disappearing under the more rigid scrutiny of structural peculiarities, which have often shown, that the most striking departures from the general rule, were attributable, not to imperfections of the rule itself, but to erroneous associations of plants, either only remotely or not at all allied, in the same groups.

The objects of this work may now be briefly summed up, they are first to explain the principles of grouping plants according to their natural affinities and illustrating these by figures of species appertaining to each group: and secondly, to show by adducing a variety of examples of the fact, that, in a great majority of instances similarity of structure, or Botanical relationship, is accompanied with similarity of properties, and lastly, to prove that these premises lead to the inference that having ascertained by careful examination and comparison its nearest Botanical relatives, the properties of which are known, we are often enabled to infer the properties of an imperfectly known plant. In addition to these more immediate objects I have endeavoured to render it a supplement to our Prodromus, by a running commentary on that work, and by the description of such new species as have come into my possession since its publication. To render the information thus embodied in these pages as easily accessible as possible, I have added a very copious index including every name and noting every page where it occurs. By this means any one is enabled with little trouble to trace a family through all the relations, whether botanical, economical or medical, in which it occurs in these pages.

How far I have succeeded in my endeavours to accomplish these objects it is not for me to determine, but I think I may safely assume that if I have failed the failure is attributable to want of judgment in the selection of my examples, and not to want of diligence in seeking for appropriate ones or of the application required in committing them to paper. My object throughout has

been to present as complete a history in all their relations, of each group, as the frequently interrupted and unaided labours of an isolated individual, cut off from all immediate intercourse with the lights of the science, could do. That blunders and imperfections are numerous, I cannot doubt, but I trust not more so than might fairly be expected in the unfavourable circumstances under which I write or than will easily be forgiven by those who detect them. The difficulty of superintending the press where the compositors and professional readers are ignorant of the language, is always great: this is in a great measure the case with the present work, and being myself, at the outset but little practised in the duty of 'reader,' I am sorry to observe that several typographical errors have escaped observation while correcting the press. Those appertaining to the names of plants have been carefully corrected in the index, and a few in the errata.

On the pictorial division of the work it is a source of much regret, that I cannot speak in terms so favourable as my too sanguine anticipations at one time gave me reason to hope—all that I can say on this subject is, that no pains have been spared by me to bring the work nearer to perfection than it has yet attained, and my exertions assuredly will not for the future be discontinued. It is however to be borne in mind that this being the first work of the kind that ever issued from the Madras press; an establishment had to be formed expressly for itself: that colours of the best qualities are not to be had at any cost, and lastly, that until the arrival of a fresh supply of paper for to the publication of the 11th number, our material was much deteriorated by age and even so far damaged as to render the use of superior colours almost nugatory. For the future this last source of failure will be avoided and I still hope, the character of the work will rise with its progress towards its termination and ensure it a continuation of that support without which, it is impossible my contracted means, can bring it to a close, the more so, as it has already involved an *outlay* so much beyond its returns, that but for the liberal aid of Government in patronizing it and its fellow the ICONES, to the extent of 50 copies each, both, must long ago have ceased to exist. In concluding this brief Preface it only remains for me to say, that in the continuance of the work the same degree of care in preparing the letter-press will invariably be bestowed, and no exertion spared towards the improvement of the plates.

MADRAS:
30*th December* 1839.

INTRODUCTION.

It is laid down as an axiom by some eminent modern Botanists, 'that nature only creates species and knows nothing of a natural system of Botany.' This, it is added, is entirely a human contrivance, founded on a consideration of the resemblances existing between the parts, properties and qualities of plants, according to which their affinities are determined, and species having the greatest degree of relationship, in all these particulars, placed next each other, in such a way, that the qualities or intimate structure of an imperfectly known plant may be inferred from a careful consideration of the known qualities and structure of those nearest to which its Botanical characters would place it in a system constructed on these principles. Whether or not this theory be just, I will not step to enquire, for, so long as the object is obtained, I feel quite satisfied that the method by which we attain it, whether a mere human contrivance or the work of nature herself, is so infinitely superior in its fitness for the supply human wants, and for furnishing matter for philosophical enquiry, to all the artificial ones that have gone before, that there can be no hesitation as to the propriety of its instant adoption, whatever may be the difficulties to be, in the first instance, surmounted in acquiring a knowledge of its principles. These in the present instance are not by any means so great as they have been represented, for, as Jussieu well observes, whatever trouble is experienced in remembering or applying the characters of natural orders is more than compensated for in the facility of determining genera the characters of which are simple in proportion as those of orders are difficult. The reverse takes place in arbitrary arrangements, where the distinction of classes and sections are simple and easy to remember while those of the genera are in proportion numerous and complicated. On this question, therefore, as there can scarcely be two opinions, it now only remains for me very briefly to explain, the principles of the arrangement or distribution of the orders adopted both in this work and in our Prodromus.

The arrangement followed is very nearly that of Jussieu as modified by DeCandolle and adopted in his Systema, and Prodromus. According to this system all plants are first distributed under two principal classes Cellular and Vascular, the former comprehending all the plants destitute of spiral vessels and of Cotyledons—Cellulares; the latter, including all the flowering plants which are furnished with both these organs—Vasculares. The vascular plants, of which only we have as yet treated, are again divided into two classes Dicotyledons or Exogenous plants; and Monocotyledons or Endogenous plants. To the former all trees and shrubs which increase in thickness from the centre towards the circumference by a succession of concentric layers of wood belong, as well as nearly all those herbaceous annuals, the leaves of which, have reticulated or anastomosing vessels. To the latter the various kinds of grasses, Lilies, Orchidiœ, Palms, Plantains, &c. belong, the vessels, of the leaves, of which pass either in straight lines from the base to the apex, or from the midril to the margin, and the leaves are sheathing in place of being attached by a joint to the stem. These distinctions are not without exceptions, but the exceptions are so few as scarcely in practice, to affect the value of the rule. These primary divisions though thus based on the most obscure and difficult portions of vegetation to investigate, the minute structure of the seed and organization of the stem, are in fact the easiest, generally speaking, of determination. The simple circumstance of a plant having a flower proving that it has spiral vessels, while the practised eye of a Botanist can, almost invariably tell, at a glance by merely inspecting the distribution of the vessels of leaves and structure of the stem

whether the seed is mono: or dicotyledonous. Having by this summary process decided to which division of the system a plant belongs we proceed with our investigation. Let us suppose the plant is dicotyledonous and that we still follow DeCandolle as our guide.

He divides *Dicotyledonous* or *Exogenous* plants into 4 sub-classes the characters of which are taken from the fructification. These four are respectively named *Thalamifloræ, Caliciflorae Corolliflorae* and *Monochlamydeae.*

I. *Thalamiflorae* are distinguished by having several distinct petals and stamens inserted on the Thalamus or receptacle of the flower, and not cohering with the calyx.—(flowers hypogynous.)

The petals and stamens do however occasionally cohere as for example in *Malvaceae* so as in some degree to resemble those of the third class *Corolliflorae,* from which however in all such cases their numerous nearly distinct, carpels distinguish them.

II. *Calyciflorae* have also several petals, either distinct or united to each other, but inserted along with the stamens on the calyx, usually through the medium of a disk lining its tube or concave portion.—(flowers pyrigynous or epigynous).

III. *Corolliflorae* have the petals united into one bearing the stamens and inserted on the thalamus, or receptacle (hypogynous).

IV. *Monochlamydeae* have either no corolla or the petals if present are united to the calyx forming together a single, not double, perigonium or verticel of flower leaves round the pistil.

Before going further it may be proper to observe, that this is a mere artificial classification intended simply to facilitate the arrangement of the orders in a linear series, and to aid in enabling us to determine to what part of that series we ought to turn to find the order of any plant under investigation. While it pretty well fulfills these objects, it must be acknowledged, that, like all such artificial combinations it is liable on the one hand to produce unnatural associations, and on the other to separate orders most nearly allied, besides presenting examples of Monochlamydeous and dichlamedyous genera in the same order. These objections, however, apply to the arrangement, only, of the orders, not to the orders themselves, which may, though individually perfectly natural, be most unnaturally placed in relation to each other, a defect, to which all systems yet proposed is more or less liable, and we may almost assume, ever will be, when we take into consideration that families of plants like provinces of a kingdom, touch each other, not by one point only but on all sides and that we might as well expect to arrange the latter in a correct, linear series as the equally irregularly formed and closely surrounded provinces, that is the natural orders, of the vegetable kingdom. All therefore that can be looked for is well constructed and correctly defined orders or provinces, the boundaries of which should be as clearly marked out as the nature of the subjects will permit. The after arrangement of these, in such a manner as to facilitate reference, or to follow out the simile of kingdoms and provinces, to teach under what latitude and longitude we must look first for the province (the natural order) and then for the town (the genus) to which the subject of our enquiry (the species) belongs. Various plans have been tried for the attainment of this desideratum, but no one seems yet to have obtained such general favour as the one the ground work of which I have sketched, even though liable to such striking defects as those I have indicated. But to proceed.

I. Thalamifloræ.—This sub-class includes all the plants originably referred by Jussieu to his 13th class (Polypetalæ hypogena) those namely with hypogynous or inferior flowers, and several petals or which has more recently received the name of Hypopetalæ: that is petals inferior to the pistil or ovary. This is a large class, presenting many anomalies, but upon the whole, generally of sufficiently easy application in practice.

II. Calycifloræ.—This sub-class is more difficult, and often not easily distinguished from either the preceding or the succeeding one. It is divided into six sections.

1. *Peripetalæ* with several distinct petals inserted on the calyx towards its base, leaving the ovary superior or free—*Leguminosæ*, the section *Potentilleæ* of *Rosaceæ*, and *Salicarieæ* all afford easily understood examples of this section.

2. *Epipetalæ*.—In this section the tube of the calyx is prolonged and lined by the torus which forms a small disk on the summit of the ovary, and the ovary is enclosed by and coheres with calyx tube: the distinct petals and stamens are inserted on the outside of the disk. The ovary is here said to be inferior or adherent and the flower superior. *Roseæ*, *Pomeæ* and *Combretaceæ*, apparently afford examples of this section, but want the disk on the summit of the ovary. *Umbelliferæ*, *Araliaceæ* and *Corneæ* are the only orders referred here as being truly epipetalous.

3. *Epicorallæ Corisantheræ;* this section differs from the last in having the petals united, forming a monopetalous corolla, bearing the stamens inserted on its tube, and the anthers not cohering round the style. The common honey-suckle is a familiar example of this section to which also the elder, the coffee, valerian &c., that is the orders *Caprifoliaceæ*, *Rubiaceæ*, *Valerianeæ* &c. belong.

4. *Epicorollæ Synantheræ:* the essential distinction between this and the preceding section consists in the anthers of this cohering by their edges, forming a tube round the style, and from the succeeding by the corolla being inserted on the top of the ovary not on the bottom or tube of the calyx.

5. To this section the vast order *Compositæ* alone belongs; as examples of which it may suffice to mention the humble Daisy, the common Thistle, the Artichoke, the Dandilion, and gaudy Dalia to enable every one to understand what is meant by a compound flower the general flower of each of these being made up of a congeries of small ones.

6. *Pericorollae:* in this, as in the two preceding sections, the petals are united into a monopetalous Corolla, but in place of being inserted on the top of the ovary, it is inserted on the tube, or towards the base of the calyx; leaving the ovary either partially or all together free.

The Lobelia, the Hairbell, and Heath tribes afford examples of this last section of the 2d class.

III. Corrolliflorae.—This sub-class differs from the three last sections of the preceding in the insertion of the corolla only, like them the corolla is monopetalous bearing the stamens, but in place of being inserted on the calyx, (perigynous) springs from the receptacle or base of the flower, inferior to the ovary, (hypogynous) hence in the language of Jussieu the section is now named *Hypocorollae* (see table below).

The Jasmines and Convolvulus afford the most familiar examples of this class but the Gentians, Trumpet flowers (Bignonia) Heliotropes, Verbenas, Solanums (Brinjal, Potatoe, &c.) all belong to it.

IV. Monochlamydeæ.—This sub-class is characterized by having a single perianth, that is, only one verticel or whorl of floral envelopes, or if two are any time present, the petals adhere to the calyx. It is divided into four sections.

1. *Hypostamineae* here the stamens are inserted on the receptacle and the ovary is free even though concealed within the tube of the calyx to which it does not adhere. The Marvel of Peru (*Mirabilis Jalapa*), so much prized as a garden ornament, and the Amaranthus appertain to this section. The flower of the former often so delicately variegated is in truth only a petaloid expansion of the calyx, and not a corolla, in the glabose inflated bottom of which, the filaments and ovary are found perfectly free This lower portion of the calyx afterwards forms the black shell-like covering of the seed.

2. *Peristamineae.* In this the stamens are inserted on the calyx, not hypogynous. *Chenopodium*, *Polygonum* and the beautiful *Begonia* are examples of this section.

3. *Epistamineae* here the ovarium is inferior cohering with the tube of the calyx, stamens, inserted on the limb, or superior. Santalum album, (Sandal-wood) and Aristolochia (Birthwort or snake-root) are well known examples of this section.

4. *Diclines* Flowers unisexual or without a perianth. To this tribe are referred *Euphorbiaceae, Urtiaceae, Piperaceae,* besides the Oak, Alder, Birth, Willow, Pine, Walnut, &c. Judging from the dissimilarity of the plants associated under this name, bearing in mind at the same time that several other orders in which declinous flowers predominate are scattered through the system, it is to be hoped future researches will tend to break up this class and by the removal of some of the orders establish a more natural distribution of the remainder: some of those now placed here seemto have been referred to it, as to a lumber room, from not knowing where to dispose of them to greater advantage.

For the remaining portion of the system *Monocotyledons* and *Acotyledons.* I shall refer for the present to the subjoined tables, the first exhibiting a *Clavis* of the system of Jussieu, the next, that system has modified by DeCandolle and adopted in our Prodromus.

I.—COTYLEDONS none.

Class 1. *Acotyledones.*

II.—MONOCOTYLEDONES.

2. *Monohypogynæ*, stamens hypogynous.
3. *Monoperigynæ*, stamens perigynous.
4. *Monoepigynæ*, stamens epigynous.

III.—DICOTYLEDONES.

§ 1. Apetalæ.

5. *Epistamineæ*, stamens epigynous.
6. *Peristamineæ*, stamens perigynous.
7. *Hypostamineæ*, stamens hypogynous.

§ 2. Monopetalæ.

8. *Hypocorollæ*, corolla hypogynous.
9. *Pericorollæ*, corolla perigynous.
10. *Epicorollæ synantheræ*, corolla epigynous, anthers united.
11. *Epicorollæ corisantheræ*, corolla epigynous, anthers free.

§ 3. Polypetalæ.

12. *Epipetalæ*, stamens epigynous.
13. *Peripetalæ*, stamens perigynous.
14. *Hypopetalæ*, stamens hypogynous.

§ . Diclines.

15. *Diclines*, flowers unisexual, or without a perianth.

A. DICOTYLEDONES, *Jussieu.*—Exogenæ, *DC.*

I. THALMIFLORÆ, *DC.*—Cl. 1. Hypopetalæ, *Juss.*

II. CALYCIFLORÆ, *DC.*

Cl. 2. Peripetalæ, *Juss.*
3. Epipetalæ, *Juss.*
4. Epicorollæ corisantheræ, *Juss.*
5. Epicorollæ synantheræ, *Juss.*
6. Pericorollæ, *Juss.*

III. COROLLIFLORÆ, *DC.*—Cl. 7. Hypocorollæ, *Juss.*

IV. MONOCHLAMYDEÆ, *DC.*

Cl. 8. Hypostamineæ, *Juss.*
9. Peristamineæ, *Juss.*
10. Epistamineæ, *Juss.*
11. Diclines, *Juss.* { § 1. Angiospermæ. § 2. Gymnospermæ.

B. MONOCOTYLEDONES, *Juss.*—Endogenæ Phanerogamæ, *DC.*

Cl. 12. Monoepigyneæ, *Juss.*
13. Monoperigynæ, *Juss.*
14. Monohypogynæ, *Juss.*

C. Cl. 15. ACOTYLEDONES, *Juss.*

§ 1. Ductulosæ, *Arn.*—Endogenæ Cryptogamæ, *DC.*
§ 2. Eductulosæ, *Arn.*—Cellulares, *DC.*

Of this system I have only further to observe that the three primary divisions Acotyledons, Monocotyledons, and Dicotyledons are strictly natural and must always be retained in every Botanical system professing to arrange plants according to their affinities. So much cannot be said for the classes: they rest with one exception on a single point of structure not in itself invariable, in the respective classes; the insertion namely, of the stamens and petals, whether hypogynous or perigynous, points not always determinable without the aid of analogy. The secondary divisions according to which the classes are grouped under four sections are still more artificial and more liable to vary, and thence so much the less to be depended upon. Though to this extent artificial, this method of arranging the almost innumerable forms met with in the

vegetable kingdom is, beyond comparison, superior to all that went before it and though the classes, in which the orders are grouped, be somewhat arbitrary, they are yet so convenient, and generally so easily distinguishable in practice, as to leave little room to doubt that the arrangement as a whole, owes much of its celebrity and its recent almost universal adoption, to that very blemish. Various attempts have however been made to remove that imperfection from this justly admired system, but, so far as I am able to judge, all only serve to show, that had Jussieu adopted any such arrangement, in place of his own, in the first instance, there is much reason to believe the sexual system, with all its imperfections, would still have reigned paramount in Botany.

" Jussieu originally prefixed no names to his classes, and the want of this was much objected to. Those which we have given have been lately proposed by Antoine L. de Jussieu in the *Dictionnaire des Sciences Naturelles;* and, although not entirely in unison with the principles of the Greek language, may be adopted as extremely useful, each being so framed as to suggest the structure of the class. Thus the commencement *Mono,* indicates the Monocotyledones. *Epistamineae,* &c. having in no part any allusion to a corolla, suggests its absence. *Hypocorollae,* and the others, allude to the corolla being of one piece, and not of distinct petals, which last is pointed out by names, *Epipetalae,* &c. The other parts of the names, epi (*upon*), peri (*around*), and hypo (*under*), need no farther explanation.

While engaged in the study of plants alone, it is obviously of little consequence whether we begin, as Jussieu did, by the Acotyledones, or by the Dicotyledones; but if we view botany as a science that treats of only one of the great kingdoms of nature, and wish to introduce it into a *Systema Naturae,* we must bring those portions of each most closely together which are most nearly linked. So that if we commence by Zoology, we must first describe the Mammalia, and end by those of a simple structure, and then take up the most allied of the Acotyledones, and follow the steps of Jussieu. But if we describe vegetables in the first place, we must begin with the Dicotyledones, and finish with the Acotyledones. When, however, a *Systema vegetabilium* is contemplated without reference to animals, it may perhaps smooth the way to the student if it commence by those more obvious, and, though of more complex formation, yet more simple to be comprehended. On this account DeCandolle has reversed the arrangement of Jussieu." (Article Botany Encyl. Brit. 7th Ed. by Dr. Arnott.)

INTRODUCTORY NOTICE.

The conditions on which this Work was undertaken, namely, a subscription list of one hundred names, (the Government having previously subscribed for 50 copies) being now nearly completed, I have much pleasure in laying before the Public the First Number. I should have felt more gratified, could I have issued this Number a month earlier, though the list of Subscribers fell considerably short of the number required, to cover the cost of the publication, in the well-grounded anticipation, that the requisite support would not have been withheld, in the event of its merits proving such as to entitle it to Public approbation. The difficulties and obstructions however, with which I found the Lithographic and colouring departments of the work beset, proved such, as not merely to prevent this, much wished-for, arrangement, but at one time threatened to put a stop to the publication altogether. These impediments have at length been surmounted, and the operations for conducting the pictorial portion of the work put in such a train, as leaves little room to doubt of ample success attending its subsequent progress.

In the present Number it is not without regret that I perceive considerable inequality in the merits of the plates, but as the last executed are the best, this circumstance, of itself, holds out the cheering prospect, that even they, though far from discreditable to the state of the Arts in Madras, still fall considerably short of the perfection, to which, I think, we may justly hope to attain.

The descriptive portion of the Work, it will be perceived, is very full, especially in the botanical details, more so indeed, than was originally intended. This course I have been in some measure forced to adopt, from having, in the course of the examination of the materials required in the composition of this division, been unavoidably led to the conclusion, that much of our ignorance of the more valuable vegetable productions of India, the arborious plants in particular, is attributable to the deficiency of botanical knowledge among us, and that whatever tends to increase the latter, will equally enlarge our acquaintance with the former. The following extract from a letter from the Council of the " United Service Museum," to Colonel Frith, of Madras, places this statement in a clear light, and shows that the view I have taken is supported by the highest authorities. It is necessary to premise, with reference to the subject of the extract, that Colonel Frith, about two years ago collected in the course of a tour, partly undertaken for that purpose, a number of specimens of the various kinds of timber in use in different parts of the country. A set of these specimens containing one hundred and eleven sorts, he sent to the United Service Museum, an acknowledgment of which, handsome donation, he received a few days ago, and sent me the extract, thinking it possible I might be able to give him some, at least, of the botanical names from an inspection of the specimens.

" You may remember I sent home specimens of timber to the United Service Museum 111 in number. They have been received, the letter of acknowledgment says ' In returning you their thanks for your very interesting collection of woods, the Council have desired me to request as a particular favour, if attainable, a list of the botanical names, corresponding to the native names affixed : this would be of infinite value, as it would permanently identify the specimen which the native name may fail to do in future years. Such a list would be a most valuable document indeed for many purposes.' "

It was not without regret that I felt myself forced to decline attempting, from such materials, to meet the Colonel's wishes, under the apprehension of doing more harm than good by assigning wrong names, but I requested and procured his permission to make known the wishes of the Council of the Museum, for the purpose of suggesting to those who might in future make such collections, the propriety of, at the same time, collecting a corresponding set of specimens of flowering slips or branches to accompany them, each being similarly named and numbered ; since, by an examination of these, the Botanical names could be ascertained. In size they need not exceed those represented in the accompanying figures, some, of which indeed were taken from dried specimens. For their preservation, all that is required is to spread them between the folds of two or three sheets of common Bazar paper, and lay them in the sun covered with a layer of sand about an inch thick. Two or three days exposure will usually suffice to dry them, after which, they will keep for any length of time, if kept in a dry place, and though their colour may be lost, they are nearly as fit for Botanical purposes, as when first gathered. Flowers and fruit are required for the determination of the order and genus ; and the leaves, to assist in indicating the species.

With such a set of specimens, I should have had little difficulty in assigning Botanical names, to probably the whole of Colonel Frith's large collection of woods: and on being supplied with such materials, will not only be happy to lend my aid in enhancing the value of such collections, by determining the Botanical names, but will feel exceedingly obliged to any one who may favour me with such a collection (whether of the trees and useful plants only, or of the plants generally growing in his neighbourhood) duly numbered, for convenience of reference in preparing counter catalogues, and labelled with the native names, as a means of enabling me to augment the usefulness of this publication, by extending the catalogue of such names in connexion with the scientific appellations under which the plants are described in Botanical works.

I avail myself of this opportunity to make a few remarks on the subject of names, regarding which, some curious, not to say unphilosophical, ideas prevail, and on which, at the commencement of a Botanical work, in a great measure addressed to unbotanical readers, it appears above all others desirable that clear ideas should be established, as no other science bears, to the same extent, the reproach of being so over-burthened with hard and learned names. Fine flowering and useful plants being general favourites among people of every tongue, each nation seems desirous, that every known plant (50,000 in number) should have a name in its own language; and no people insist on this privilege more strongly than the English, nor any, with less reason; since they have not English names for many of their own indigenous plants! though the whole English flora scarcely furnishes 1500 flowering species; nor for above a few hundreds (apart from mere translations of Botanical names) for upwards of 20,000 exotics now in cultivation in their stoves and conservatories.

In spite of this paucity of the English language in names of plants, the English people seem to expect Botanists to find English names, I verily believe, for every plant under the sun, and in conversation, such is their horror of even well-sounding and easily pronounced Botanical names; that they will rather adopt any other, however barbarous, unpronounceable or unmeaning, than be guilty of so great a solecism as that of using one; fearful no doubt, of incurring the opprobrious cognomen of a "Blue!" In England, where the plants spoken of are English, and have English names (though even there the same plants often bear very different names in different counties) this is well enough, but when we carry this prediliction for English names out of the country, it becomes ridiculous, for how can a plant probably never before seen by an Englishman, have an English name? As well might a Hindoo expect to find Tamul or Telugoo names in England, as an Englishman, English names of plants in India: but if in the absence of these, we are disposed to content ourselves with native names, we must bear in mind, that in India, as in England, the same plants have different names in different provinces, and not unfrequently the same name is given to a variety of plants, or *vice versa*, a great variety of names to the same plant, rendering the knowledge of very difficult acquisition, and when acquired of comparatively little value. Added to these impediments to the acquisition of a correct knowledge of vernacular names of plants, we know that these names, being preserved, not by descriptions and figures which limit them invariably to the same species, but by tradition, are therefore in course of time, through mistakes of persons repeating them, liable to change, by being applied to plants different from those, to which they were originally given, the only way indeed, to account for the wide discrepancies often found in the names given to the same plants by different persons speaking the same language. For these, in my opinion, weighty reasons, I trust I shall not be blamed for seldom introducing native names into the body of this work, and for indulgingthe hope, that those desirous of obtaining a correct knowledge of Indian Plants, will for the future, as much as possible, adopt their Botanical nomenclature. Being at the same time aware, that one, and not the least important, object of Botany is to fix these vascillating vernacular names, and render them useful towards the advancement of science by connecting them with their comparatively stable Botanical ones, I am most desirous of receiving lists, in different native languages, of the plants figured in this work, as well as the collections mentioned above, with a view to the formation of a comprehensive catalogue and index of both.

To prepare a complete catalogue of native and scientific names in any one language, is always a work of great difficulty, but in this country, where so many languages are spoken, requiring for its successful execution, by any one man, a rare combination of talent and acquirement. Such a catalogue has however been already, to a great extent, completed in Mr. Piddington's "*English Index to the plants of India*," a compilation of the highest merit, but yet, strange to say, almost unknown and unheard of in this part of India. To those desirous of knowing what has already been done in this department of Indian Botany, I would strongly recommend this most useful Index, both on account of its actual contents, and as a model, for its own extension. The "*Tabular view of thegeneric characters of Roxburghs Flora Indica*," by the same author, forms a most suitable companion to the Index; and one, which I should say ought never to be separated, as a reference to it, will often enable the investigator of native names to ascertain whether the native teacher is giving correct information, by showing whether the plant named, belongs to the genus to which his name refers.

MADRAS, 20*th February* 1838.

ILLUSTRATIONS

OF

INDIAN BOTANY.

RANUNCULACEÆ.

The species of this Order are nearly all extra-tropical. In India, a few only have as yet been found on the plains, but there are a considerable number natives of the higher hills.

The members of this family are for the most part readily distinguished by their habit, and by the analogy of their organization. The calyx; consists of several distinct, deciduous sepals, often coloured, or petaloid, and in the absence of petals performing the functions of both organs; in number, varying from 3 to 15, the estivation, generally, imbricating, but sometimes valvular, or with the edges folded in, as in Clematis. Corolla; sometimes wanting, as in most of the species of Clematis and Thalictrum, or composed of from 5 to 15 distinct petals. Stamens; usually numerous, anthers adnate, opening outwardly, inserted with the petals below the pistils. Pistils; usually united in form of a head in the centre of the flower; ovaries, each, one celled, with a single ovule, (aechnia) or many seeded and capsular, as in Aconite and some others; style always lateral, sometimes very long and plumose. Seeds albuminous, when solitary, either erect, or pendulous from the apex of the cell. Embryo minute, enclosed in a horny albumen. Plants, usually, herbaceous, with exsti-pulate leaves, sheathing at the base, generally, much divided; more rarely, scandent shrubs: the hairs, when present, simple.

Though generally an easily recognised order, the Ranunculaceæ have strong affinities with some other orders, which however, differ widely among themselves. I do not think it necessary to indicate here their more remote and less striking affinities, but will briefly mention a few of their nearest allies.

With Dilleniaceæ and Magnoliaceæ, they associate in the position, number and structure of their parts of fructification; but from the former, they are separated by the want of an aril to the seed, their deciduous calyx, and generally, by their very different habit. This last distinction is however weakened, through the twining habit of Tetracera and Delema associating them with the fruticose and scandent genera Clematis and Naravelia, while the herbaceous habit and sheathing leaves of Acrotrema, associate it with the more common herbaceous forms. From Magnoliaceæ they are readily distinguished by the absence of stipules, difference of sensible qualities, and habit. With Rosaceæ, though differing toto cœlo in their sen-

sible qualities, the Ranunculaceæ have many structural affinities; their numerous carpels, the number of their floral divisions, indefinite stamens, and the analogous habit observed in many species of both orders, all indicate this relationship; but, they are at once distinguished by the petals and stamens in Rosaceæ, being inserted on the calyx, or perigynous, while in Ranunculaceæ, they are both inserted under the ovaries, or, hypogynous.

Many other analogies might be indicated, but enough has been said to show the absolute necessity of attending to every point of structure in determining the order of any plant under examination, for, the order once ascertained, it is in general a comparatively easy task to make out the genus: one, and not the least of the advantages which the natural method possesses over the artificial, or sexual, system; as in it, a glance often serves to ascertain the class and order of a plant, but leaves the difficulty of determining the genus little of all diminished, while in all cases of departure from the regular form, such as the addition or suppression of a stamen or pistil, not a very rare occurrence, the Botanist unacquainted with the laws which give rise to, and regulate these metamorphoses, has no guide to direct him, where else in the system, to look for the plant under investigation. With the view therefore of facilitating the determination of orders, I shall usually append a summary of the essential characters of each; promising, however that these summaries must be received with considerable latitude, as it is often impossible to compress within a few words even the leading characters only: but *they* may serve as helps, by directing attention to those points of structure which are considered essential to the order.

Essential Character. Flowers polypetalous, polyandrous, ovaries wholly superior: leaves without stipules: seeds without an aril, with copious fleshy albumen. A few have definite stamens, and Clematis, Thalictrum, and some others, are without petals; but agree in all other respects with the characters indicated.

Geographical Distribution. As already stated, this considering its great extent, in a remarkable degree an extra-tropical order. A few only are found in India within the 25° of North Latitude, and these, with the exception of 8 or 9 species, are confined to the temperate climate of the higher hills, thus affording a striking instance of analogous organization and habit, pervading nearly the whole of an extensive family of plants, and an instructive example of the effect of these in determining the geographical distribution of its species, showing in another and very favourable point of view, the advantage we derive from studying plants according to this method, since, by enabling us to generalize our isolated observations on the structure, habits, and peculiarities of individual plants, it suggests their extension to whole families, and teaches us how we may by studying carefully the peculiarities of a single species, learn by analogy those of a whole order, a sort of alebriacal method, if I may so express myself, of studying vegetable physiology, which has within the last few years led to many most important discoveries in that science. To show that this is no hypothetical statement it is only necessary to adduce the fact, that the generally received division of the vegetable kingdom into three great classes, Acotyledons, Monocotyledons, and Dicotyledons, has become so simplified in its application to practice, that it is no longer necessary in determining to what class plant belongs to undertake the often difficult and delicate operation of dissecting the seed, since its structure is generally indicated by such palpable differences in the formation of the stem and leaves as render the most cursory inspection of those parts sufficient to determine the class to which the plant belongs. It would certainly be going too far out of my way to enter upon the examination of these distinctions here, suffice therefore to state, that such is the case, and that a reference to any of the recently published Introductions to Botany, or to the concluding pages of the preface of my Prodromus,* will furnish an exposition of, the observations on which the principles are based. But to return from this digression. Twelve out of fifteen species known to me as indigenous in this peninsula, are only found on the higher hills, the remaining three, which are all twining shrubs, are met with on both hills and plains, but more frequently on the former than the latter. One of them, Climatis Gourrana, which I frequently met with in Mysore, appears admirably suited, from the profusion of its fine clusters of flowers, for the formation of arbours in the manner some of its congenus are employed in Europe. Of the

* Prodromus Floræ Penins. Ind. Oriental.

herbaceous forms, I formerly remarked (Madras Journal No. 11) that when found within the tropics they almost invariably occupy the highest hills, where reduction of temperature, consequent on great elevation, compensates for low latitude; that the shrubby forms partake more of the tropical character, since they are found, sparingly it is true, in most tropical countries. I thence inferred, and have as yet seen no reason to alter my opinion, that wherever we meet with the former within the tropics, we may feel well assured, we have attained an elevation sufficient to place us beyond the influence of what has been called the 'fever zone' or range of jungle fever, so commonly met with in the belts of jungle, which embrace the more elevated slopes of all our high hills; and that their absence on the Shevaroys, were we otherwise unacquainted with the fact, might be adduced as an evidence, that they had not attained that degree of elevation, and ought therefore to have been carefully examined, before their perfect salubrity and suitableness for a sanatarium was proclaimed.

Properties and Uses. In Europe many species of this order are deservedly held in high esteem as affording some of the finest ornaments of the flower garden, among which may be mentioned, the *Ranunculus Asiaticus* and *Aconitum Napellus;* the former, supposed to be of Persian origin, and probably of easy introduction, from its native country, into India. Should this be attempted, I may here mention, that it requires to bring to perfection a deep rich moderately humid soil—As an arbour either the *Clematis Gouriana,* or the one here figured might be used. The latter would certainly form an exceedingly rich and handsome one, from the snow-white interior surfaces of its numerous large flowers contrasting finely with its dark green foliage, but it also will require for its successful culture, a very rich and deep vegetable soil, with abundance of water. The former may perhaps, prove of easier culture while its more numerous, clustered, flowers might compensate for their smaller size.

Remarkable as the family likeness existing among these plants, as traced in their geographical distribution may appear, it is even more strongly indicated in their properties. Of these, so far as the species of lower India are concerned, nothing seems known: none of them are represented by Rheede, in his Hortus Malabaricus, nor is there any of them mentioned by Ainslie in his Materia Medica of Hindoostan; while Roxburgh confines his notice, of the few he knew, to their botanical description. To the Natives of this part of the country, they seem utterly unknown, as I have not been able to trace even a name, appertaining to any one species, among them.

It would however be injudicious to infer from this general silence regarding the Indian representatives of this curious tribe of plants, that they are inert, while nearly all the other members of the family are so remarkable for the active properties with which they are endowed. 'Acridity, Causticity, and Poison' are emphatically said to be 'the general characters of this suspicious order.' The acrid property is, however, for the most part confined to the recent plant, the principle on which it depends being so volatile that simple drying, infusion in water, or boiling, dissipates it, though in the recent state, it is so active that many species excite, when applied to the skin, violent inflammation, followed by blisters: a purpose for which they were much employed, previous to the general introduction of Flies, since which they have been nearly expelled from medical practice as epispastics, owing to the virulence of their operation, and consequent liability to induce obstinate ulcers. When taken internally in sufficient doses, several species of Clematis produce all the effects of poisoning, but have notwithstanding been employed in several diseases, and are said to afford valuable remedies, a statement, which may be doubted as nearly the whole tribe, with a few exceptions, has fallen into disuse as medicinal agents; Hellebore being almost the only one of the evacuants retained, and that, from the uncertainty of its operation, is seldom used. The roots however, of *Hydrastis canadensis,* and *Coptis tri-foliata* (golden thread) are used in North America as tonics, and Dr. Wallich informs us, that Coptis teeta, Wall. is similarly employed in Assam. The genus Aconitum appears to be that in which the poisonous properties are most prominently developed, the roots of Aconitum ferox, Wall. or Bish or Bikh of the Nepalese, ranking among the most virulent of vegetable poisons, while those of A. Napellus (the common monkshood of English gardens) are so active, as to have caused numerous accidents to Man, and are employed by the Swiss, mixed with food, to poison the Wolves which so generally infest their country. Might not the Nepaul one, which retains in drying its active properties, be similarly

employed in this country for the destruction of Tigers, &c.* The Goorkahs endeavoured to protect their country against foreign invasion by poisoning the wells with it, and at one time the Konds were supposed to have had recourse to similar means to protect their country against the British troops. The plant used by the latter for this purpose, is still unknown, though it appears, from the statement of a Medical Officer employed in the first campaign, that the attempt was at first attended with partial success, in as much as several men were suddenly taken ill, who had partaken of the water of a well adjoining their camp, in which, on being dragged, a quantity of an unknown, and supposed poisonous root, considerably decayed, was found. The poisonous plant so employed in that part of the country is still unknown, but I dare say might on inquiry be ascertained.

While thus abounding with acrid and poisonous plants, the order includes a few of a different complexion. Several of its species are regarded as simply astringent: the seeds of Nigella, are pungent like pepper, and are employed in some parts of Europe as such, under the name of Allspice; (not the true English Allspice, which is derived from a very different source) and all the species of Coptis, are simply bitter and tonic. The Mishme teeta of Assam, *Coptis teeta* Wall. is in high repute among the Assamese, the taste of which is described by Wallich "as intensely and purely bitter, very lasting, and with only a very slight aroma." This plant has been introduced into the Calcutta botanic garden, and at the time the account was written, promised to survive the great change of climate.

To devote more space to an exposition of the properties of extra-indian species of an order so little known in Southern India, would, it appears to me, be out of place in a work, principally devoted to the botany of these regions, I shall therefore conclude my remarks regarding it, with a few observations on some of the genera and species, of this portion of India.

Observations. The number of genera yet found in the Southern provinces of India and Ceylon, amount, so far as I know, to only seven; and of these I feel inclined to consider Adonis a doubtful native. The number of species with which I am acquainted now extends, for both countries, to 16, two new ones having been added to Clematis, and one to Ranunculus, since the publication of my Prodromus. The former are readily distinguished from the previously described, Peninsular, species, by their flowers being fewer and larger sized than those of any of the preceding ones, while in both, the leaves are ternate and simple, in place of pinnate as in them. In addition to these I possess specimens of a third form, but not in flower, closely allied, to *C. Wightiana*, but so far as my imperfect specimens, of both species, enable me to judge, distinct.

* Dr. Wallich (Plant Asta Rar) states, on the authority of Henry Colebrooke, Esq. that the Bikh is employed in the northern part of Hindoostan for destroying Tigers, but in a way different from that here recommended. "Arrows poisoned with that drug are shot from bows fixed near the tracks leading to their watering places, and it generally appears that the animal is found dead at the latter." The following extract from Mr. Royle's Illustrations, &c. embraces in a condensed form nearly all the information we possess respecting its properties and uses.

In all the native works, the *Bikh* is represented as being a deadly poison, even in the smallest doses. The Hindoo works quoted by Dr. Hunter, describe it as being at first sweetish (hence the affix *meetha*, sweet), and then followed by a roughness on the tongue, or as it is expressed in one work, "seizing the throat." Dr. Buchanan has informed us, that it is equally fatal when taken into the stomach, and when applied to wounds: hence used for poisoning arrows and killing wild animals. The futility of the Gorkhas attempting to poison the springs of water was shown in the last campaign, and Dr. Govan has proved the improbability of deleterious exhalations from this plant being the cause of the unpleasant sensations experienced at great elevations, inasmuch as it is only found much below where these are experienced. But as it is a root of such virulent powers, it has no doubt been frequently employed as a poison, and its sale was therefore prohibited by the native powers in India. Notwithstanding this, the Hindoo physicians, noted for the employment of powerful drugs such as arsenic, nux vomica, and croton, do not hesitate to employ this also in medicine. In the *Taleef-Shereef* it is directed never to be given alone; but mixed with several other drugs, it is recommended in a variety of diseases, as cholera, intermittent fever, rheumatism, tooth-ache, and bites of snakes. It is also used as an external application in rheumatism in the north-western provinces. Mr. Pereira's experiments have shown that this root, either in the form of powder, watery extract, or spirituous extract, is a most virulent poison: but of these forms the last is by far the most powerful. "The effects were tried by introducing this extract into the jugular "vein, by placing it in the cavity of the peritoneum, by applying it to the cellular tissue of the back, and by "introducing it into the stomach. In all these cases, except the last, the effects were very similar; namely, "difficulty of breathing, weakness, and subsequently paralysis, which generally commenced in the posterior "extremities, vertigoes, convulsions, dilatation of the pupil, and death, apparently from asphyxia." (*v. Wall. Pl. Asiat. Rar. loc. cit.*)

In the genus *Ranunculus*, the examination of Ceylon specimens of what appears to be the true *R. pinnatus* of Poir, has, since the publication of our Prodromus, led both Dr. Arnott and myself to the conclusion, that our *R. Wallichianus* can scarcely be kept distinct from that species. In addition to *R. pinnatus*, Ceylon possesses one so closely allied to *R. reniformis*, that it is only distinguishable by the member of its petals, that in the former being usually 5, while in the latter it is from 10 to 15, unless in those instances where they appear fewer from the union, among themselves, of petals; several instances of which I have observed. The petals of the Ceylon plant, are however much larger than those of the continental one, hence we might almost infer the smaller number, which is the only good distinguishing mark between them, originates in the one case, from the constant union of adjoining pairs of petals similar to what I have observed to occur partially in the other, a view, which, is supported by the fact, that the continental plant has sometimes, though rarely, the number of its petals augmented from 10 to 15, or in the proportion of three to each sepal; perhaps, the normal form, thus showing in the frequent diminution of the number of its petals to 10, a similar tendency to union. Should further acquaintance with these plants show a similar tendency to multiplication of petals, in the Ceylon one, and a still further disposition in ours to reduction, these two must ultimately be united, though for the present, it is my intention to keep them distinct.

Clematis.

1. C. *Munroiana* (R. W.) Climbing: glabrous, except the calyx: leaves ternate, long petioled; leaflets broadly ovate, acuminated, rounded, or slightly cordate at the base, 5 to 7 nerved, quite entire: peduncles shorter than the leaves, 3, rarely 1, flowered, from the axils of simple, ovate, or ovate-lanciolate, floral leaves, and bearing two lanciolate bracts below the middle: sepals lanciolate, expanding, or revolute; stamens equalling the sepals: styles long plumose.

Moist woods, Neelgherries, and Pulney mountains, flowering in September.

I have much pleasure in dedicating this very fine species to Lieutenant Munro, H. M. 39th Foot, the talented Secretary to the Mysore Horticultural Society, an enthusiastic and promising botanist, who found it on the Neelgherries about the same time that I did on the Pulney mountains.—*Plate* No. 1.

An extensively climbing shrub, every where glabrous, except the exterior surfaces of the sepals, which are clothed with brownish hairs. Leaves long petioled, 3 foliolate, pedicels of the leaflets long, and cirriform; leaflets, broadly ovate, oblong, rounded, or sub-cordate at the base, acute, or somewhat acuminated at the point, usually 7, rarely 5, nerved at the base, quite entire; floral leaves, in every respect like the leaflets, except, that they are smaller and short petioled. Peduncles solitary, from the axils of, and longer than these foliacious bracts, 3 flowered, and furnished below the middle with two opposite, lanciolate bracts. Flowers large, white; flower buds, ovate, oblong. Sepals 4, lanciolate, spreading or revolute, about an inch long, white within, clothed, externally, with rusty brown shag. Stamens numerous in several series, the exterior filaments compressed, equalling the sepals; anthers small, pointed. Pistils numerous, ovary hairy; styles long, feathery; stigma pointed. Fruit not seen.

2. C. *affinis* (R. W.) Climbing: glabrous, except the sepals: leaves 3 foliolate, leaflets acutely toothed, ovate, serrated, acuminated, 7 nerved; peduncles one flowered, from the axils of simple foliaceous bracts: flowers drooping, sepals ovate, acuminated, twice the length of the stamens.

Shevagerry mountains in woods, flowering in August.

This species is I fear too nearly allied to the former, from which I have been induced to separate it, on account of its serrated leaves, constantly one flowered peduncles, its much smaller flowers, (about half the size) and lastly, on account of the great disproportion between the relative length of its stamens and pistils, and sepals.

The third form alluded to above as so nearly allied to C. *Wightiana* differs in the following respects. In C. *Wightiana* the leaves are pinnate, consisting of one pair of leaflets, and an odd one, in this there are two pairs; in that, each leaflet is deeply 3 parted, or divided into three distinct, short pedicelled, secondary leaflets; in this, they are all entire, or but slightly 3 lobed: but in both, they are coarsely serrated, cordate at the base, and very villous on both sides: the flowers I have not seen, and suspect the differences noted depend on variations in the form of the leaves on different parts of the same plant, a point, which I hope some of the residents on the Neelgherries, where I believe it grows, will enable me to clear up.

Thalictrum.

3. T. *glyphocarpum* (W. and A.) This species originally from the Neelgherries, is now ascertained to be a native of the higher parts of Ceylon, where it has been found by both Colonel Walker and myself.

Ranunculus.

4. R. *reniformis* (Wall.) Erect, hairy: radical leaves roundish ovate, reniform, or reniform cordate at the base, coarsely serrated; lowest scape leaf oblong, toothed, narrowed at the base into a petiol; upper ones nearly linear: petals numerous, 10—13, twice as long as the patulous calyx: heads of fruit globose: achenia oblong, tumid, minutely dotted: style nearly straight.

Neelgherries and Pulney mountains, flourishing in September and October.

I have modified, a little, the character of this species to bring in the form here figured.—*Plate* No. 2.

5. R. *hastatus* (Walker's MSS.) Erect, glabrous, except the petiols of the radical leaves: radical leaves, reniform cordate, or deeply reniform hastate at the base, lobes broad, roundish, coarsely serrated; scape leaves, lanciolate, toothed, attenuated at the base into a broad

petiol: petals 5, roundish obovate: heads of fruit globose, achenia tumid, minutely dotted; style straight, or slightly hooked at the apex.

Ceylon, plains of Nuera Ellia in marshy and low pastures.

I am informed by Colonel Walker that he has also found it on Horton plains, at a considerably greater elevation, where the plants become smaller, the lobes of the leaves less developed, and altogether more like R. *reniformis.*

6. R. *pinnatus* (Poir). The character given of R. *Wallichianus*, is nearly applicable to this species, with the exception of the leaves being described as merely hairy, in place of hispidly villous; a character apparently of little value in this species, as the clothing varies in degree on both Ceylon and Continental specimens. It is readily distinguished however from the nearly allied *R. subpinnatis* by its murciated, not smooth, achenia.

EXPLANATION OF PLATES.

1st.—Ranunculaceæ.

1. Clematis Munroiana, branch, with leaves and flowers, natural size.—2. Receptacle, with ovaries, styles and stamens showing the different series of the latter magnified.—3. Back and front view of filament and anther magnified.—4. Receptacle cut vertically.—5. Ovary, with its attached feathery style, much magnified.

2d.—Ranunculaceæ.

1. Ranunculus reniformis, natural size.—2. Receptacle, showing stamens and ovaries, the sepals and petals removed.—3. A detached petal showing the nectarial scale at the base.—4. Back and front view of the anthers.—5. Ovary detached.—6. Carpel cut vertically. All more or less magnified.

DILLENIACIÆ.

In this order the calyx is 5 sepaled, hypogynous, and persistent; three of the sepals exterior and two interior: the corolla 5 petaled, deciduous, the stamens numerous, usually, all distinct and free, but sometimes monadelphous or polyadelphous, placed either all round the pistils in the usual way, or confined to one side of it: filaments, when free, dilated at either the base or apex: anthers adnate 2 celled, either elongated and bursting longitudinally, or short with the cells united at the tip only, and placed transversely across the dilated point of the filament. Pistils definite in number, ovaries, usually, from 3 to 5, but sometimes numerous, rarely solitary, more or less united, and terminated each by a straight style and truncated or toothed stigma; ovules, frequently numerous, sometimes reduced to two, or even one, pendulous or erect. Fruit composed of as many one-celled carpels as there were ovaries, either altogether distinct, or more or less cohering. Seeds usually, by abortion, few or solitary, attached in a double row to the inner edge of the carpels, and surrounded by a pulpy arillus; the testa hard, embryo minute, lying at the base of a fleshy albumen.

Handsome flowering trees or shrubs, are the most prevalent forms in this order, some of the former affording excellent timber, the latter usually climbing or prostrate, a few herbaceous plants are also met with. The leaves are usually alternate, and exstipulate, coriacious, with strong veins running straight from the midrib to the margin; peduncles solitary, or several springing together from tubercles on the branches, or forming terminal racemes or panicles. Flowers often yellow.

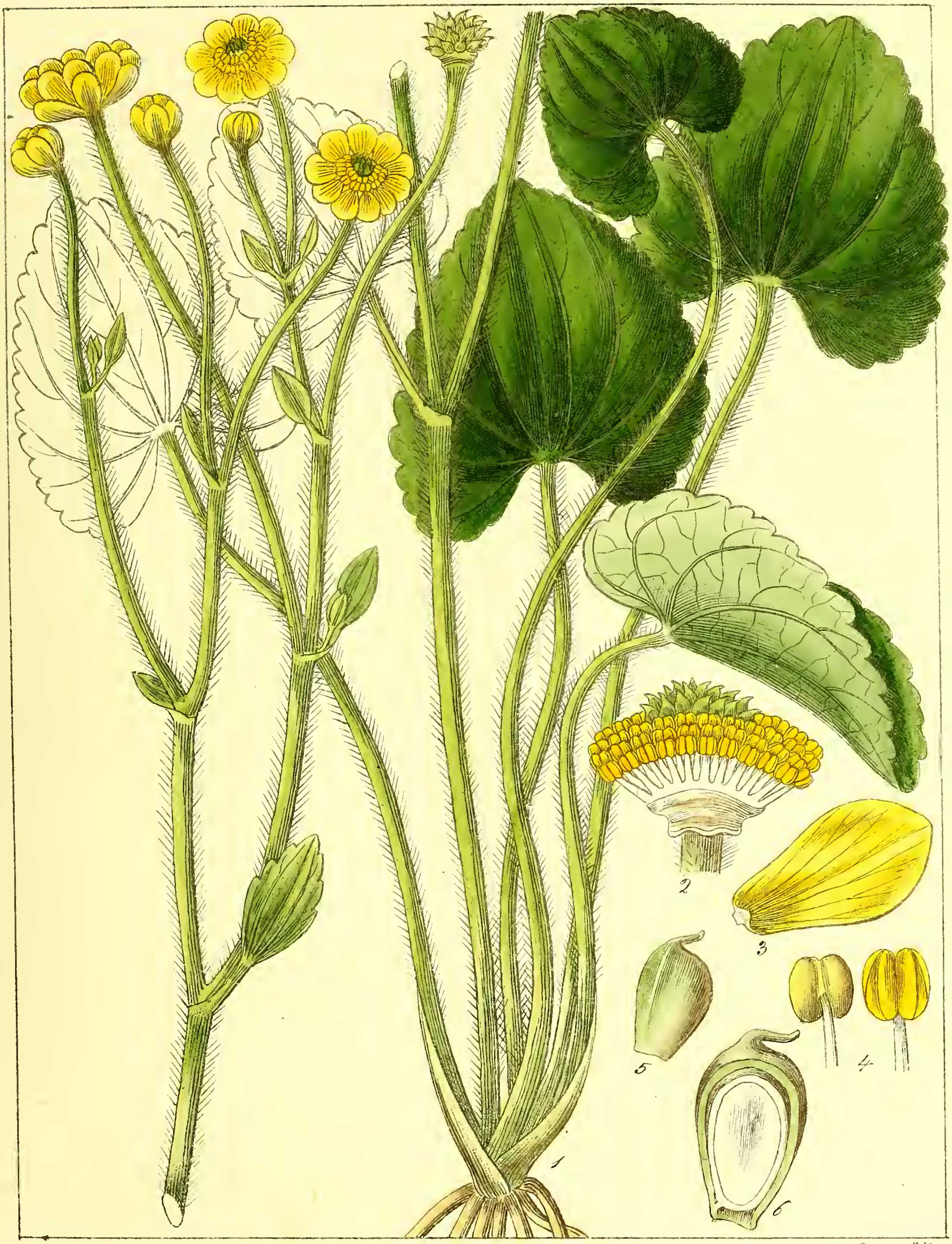
Affinities. The affinity existing between *Dilleniaceæ* and *Ranunculaceæ* has been already adverted to; they are also nearly akin to *Magnoliaceæ*, from which they are distinguished by the absence of stipules, (*Wormia* excepted) by their persistent calyx and stamens, and lastly, by the quinary arrangement of their parts of fructification, the petals forming a single, not several, series. They are universally distinguished by the presence of an aril to the seed, and generally by the peculiar venation of the leaves; the veins running straight from the midrib to the margin, and frequently projecting in form of a tooth. The very remarkable one-sided development of the stamens, in some of the genera, is peculiar to this order.

From *Anonaceæ* they are separated by nearly the same characters as those which separate them from *Magnoliaceæ*, namely, the persistent calyx and quinary arrangement of the floral envelopes; but in both, the leaves are exstipulate.

Essential Character. Flowers polypetalous, polyandrous, ovaries wholly superior: carpels more or less distinct, or solitary: embryo minute: seeds with an aril, leaves exstipulate, except *Wormia.*

Rungia del. R. W. lith.

CLEMATIS MUNROIANA. R.W.



Rungia del. R. W. Sith

RANUNCULUS RENIFORMIS. WALL.

Geographical Distribution. This is peculiarly a tropical order, almost as exclusively so, as *Ranunculaceæ* is an extra-tropical one, a few only extending beyond the 30th degree of latitude. The species are natives alike of both hemispheres, most numerous in the southern. Australia may indeed be said to be the head quarters of the order, 50 species, natives of that country, being known and described by DeCandolle, when Asia and America could only boast of 21 between them, and Africa of 3; several however have since been added to the list, from both Asia and America, and one or two from Africa, but probably very many yet remain undiscovered in so vast a continent as Australia. Dr. Wallich has figured several new ones in his splendid *Plantæ Asiaticæ Rariores*. Blume has described eight in his additions, (Bijdragen) to the flora of Java, and there are still several undescribed species in Ceylon in addition to the one here figured. To the peninsular flora two are added, unknown when DeCandolle wrote, and it is probable more will be found when the rich forests of Malabar and the alpine valleys of the Northern Circars have been better investigated, both of which stations supply us with the same species.

Properties and Uses. Nearly every thing that is known appertaining to this order is expressed in the following brief summary. " Fine plants, almost exclusively confined to tropical countries. *Dillenia speciosa* a native of India, is a most noble tree, with large yellow flowers, rivalling those of a *Magnolia*. *Hibbertia volubilis* is a green house plant, well known for the beauty of its blossoms and their powerfully fœtid smell. The medical properties of this order are scarcely known ; a decoction of their leaves or bark is astringent and used for gargles ; and the fruit of some of the species of *Dillenia* is used in India, mixed with water, as a pleasant beverage in fevers. The foliage of some of the species is extremely scabrous, whence the dried leaves are used for the same purposes as fish skin, and sand paper in Europe, those of *Trachytella aspera* are even employed in China for polishing metal." *Loudon's Encyclopædia of Plants* 1055.

It is certainly, to me, a matter of surprise, to find plants so fine as all the species of *Dillenia* are, so totally neglected in our gardens aud lawns. From the facility of their culture and propagation we might expect them to be of frequent occurrence, and yet, to the best of my recollection I never saw a single species of this fine family in cultivation in India. In England where they are more attentive to the ornaments of the garden, *D. speciosa* is of frequent occurrence in hot houses, being prized, not less on account of the magnificence and beauty of its flowers, than for the facility of its propagation. " They thrive best in loamy soil. Ripened cuttings not deprived of their leaves, strike root freely in a pot of sand, plunged under a hand-glass in heat. Good seeds sometimes arrive from India; placed in a moderate hot-bed frame they will succeed well." Such are the brief and easily followed directions for the culture of these plants, which, I hope ere long, to see acted upon by the Horticultural Society for the diffusion of these beautiful trees among us. The species of *Wormia*, one of which is a native of Ceylon, are not less deserving of our attention, on account of the magnificence of their foliage and beauty of their flowers. Several species of *Dillenia* are large trees, and afford valuable timber on account of its hardness and durability.

As stated above, little is known regarding the properties of *Dilleniaceæ* : the leaves and bark of several are astringent, and decoctions of them are used as gargles and as washes for ill conditioned sores. The fruit of most of the species of *Dillenia* are acid, and used by the Natives in their curries, while the enlarged fleshy calyx of the ripe fruit, sometimes furnishes Europeans with " a tolerably pleasant jelly."

Remarks on the Genera, &c. Roxburgh, as appears from his Flora Indica, was only acquainted with nine species of this order, which he referred to two genera *Tetracera* and *Dillenia*. These nine are now distributed among four genera, his *Tetracera Sarmentosa* being the *Delima Sarmentosa* of all modern authors, and his *Dillenia Pentagyna* having been raised to the rank of a distinct genus, though, as it appears to me, on insufficient grounds, under the name of *Colbertia Coromandelina*. To these four original Asiatic genera, several others have recently been added. Vahl founded *Schumacheria* on a Ceylon plant, DeCandolle *Trachytella* on one from Cochin China, Jack *Acrotrema* for a Malayan one, and Blume *Capellia* for a Javanese one, Lindley *Actinidia* for one from Nepaul. To these it may be added, that *Wormia* has been discovered in Ceylon, making up the number of Asiatic genera to 10 out of 26, the total number yet discovered.

Of these 10, four are certainly natives of the Indian Peninsula, namely, *Tetracera, Dillenia, Colbertia,* and *Acrotrema: Colbertia* however, being only separated from *Dillenia,* by having a few of the stamens sterile and longer than the rest, and fewer pistils. This last character is now of no value, owing to some species recently referred to the genus, on account of their sterile stamens, having as many as 12 styles, the remaining distinction, sterile stamens, does not seem sufficient to authorize its removal as a separate genus, on which account, Dr. Arnott and myself, following Roxburgh, reunited it to the older genus, thus leaving only three for the Peninsula. *Delima Sarmentosa* quoted by Roxburgh as a Peninsular plant on the authority of Rheede's figure (Hort. Mal. 7 tab. 53) has not yet been found on the continent of India, Rheede's figure representing a plant not even referable to the order. The genera *Acrotrema* and *Schumacheria,* the ones here figured, require a somewhat more detailed notice. The former was established by the late Dr. Jack in the Malayan miscellanies for a Malay plant first discovered by him: since then two species have been discovered in Malabar, and some others in Ceylon. Some of the Ceylon ones I have seen, and think quite distinct from the Malabar plants, but owing to my not having specimens I do not attempt to characterize them. The genus was thus briefly defined by its discoverer, " *Calyx* pentaphyllus. *Corolla* 5-petala, patens. *Stamina* 15, erecta, *filamentis* brevibus, *antheris* longis, linearibus apice biporis. *Ovaria* 3, distincta, 2-spora, ovulis angulo interiori affixis. *Stili* 3. *Stigmata* simplicia. *Capsulæ* uniloculares—*Herba acaulis, pilosa, pedunculis racemosa multifloris.*" With this character both *A. costatum* and *Wightianum* sufficiently agree, but the species now added calls for some modifications to admit of its being received into the genus. Thus in *A. Arnottianum,* in place of 15 there are nearly 30 stamens, in place of 2 ovules they are very numerous, and in place of one or at most two seeds I have observed nearly 20 in one carpel. The inflorescence also differs; for in place of a short raceme, on the extremity of an erect naked scape they are borne on a procumbent sucker-like branch, covered throughout with appressed scale-like bracts, from the axils of which, the long filiform pedicels spring.

The species equally require revision since the addition of *A. Arnottianum,* but that I feel averse to attempt until I receive specimens of the Ceylon species, I shall therefore content myself for the present by stating that *A. costatum* and *A. Wightianum* seem, from description, very nearly allied, if indeed distinct, (our former character is referable, partly, to two, very distinct, species, owing to our specimens of both, being so very imperfect as to prevent their being recognized as distinct) while *A. Arnottianum* is so widely removed from both in every thing but habit, that it may almost be considered a distinct genus. In the former, the flowers are borne on an erect scape, and the carpels 1-2 seeded; in the latter, they spring from, apparently, an abortive surculus (sucker) and the carpels are many seeded.

The genus *Schumacheria* was originally established by Vahl, and published in a German periodical, apparently little known, and seems to have been so imperfectly described, that DeCandolle with all his care and research, seems either to have overlooked it, or was unable to determine its affinities and place in the system of plants, as it is not taken up in his *Systema Naturale.* Springel has equally overlooked it, and has even published another, and very different genus, under the same name: hence we may conclude the genus was virtually lost until resuscitated by Dr. Arnott, who published a revised character in Jameson's New Philosophical Journal for April 1834. His character, though detailed and accurate, seems still to have left some point doubtful, as Professor Lindley in the second edition of his excellent " Natural system of Botany," has placed it at the conclusion of his arranged list of genera of the order, as if uncertain, either of its proper place or whether it actually belonged to the order. A genus so little known, and which may be found to merit a different fate, I have thought a suitable subject for this work. In the specific name I have followed Dr. Arnott, this being undoubtedly his plant, though it is possible, Vahl's may be a different one, as I am informed by Colonel Walker, that he has recently met with several other species, all quite distinct from the one here represented, descriptions of which I hope by and bye to have an opportunity of introducing.

Acrotrema.

Generic Character. *Stamens* 15-30, erect: *filaments* short: *anthers* adnate, long, linear, opening by terminal pores. *Ovaries* 3, adherent at the base only, each terminated with a *style* and simple *stigma:* ovules few or many in each. *Carpels* 3, capsular: *seeds* 1-20, furnished with a membranous aril.

Herbaceous low plants. Leaves all radical. Petiols short, their margins dilated into membranacious, somewhat sheathing auricles. Peduncles either erect scapes, bearing a short terminal umbel-like raceme; or sucker-like, clothed with dry scale-like bracts, from the axils of which the long, slender, one-flowered peduncles, spring.

Rungia del. R. W. Lith

ACROTREMA ARNOTTIANUM. R.W

Rungia del. R. W. Lith.

SCHUMACHERIA CASTANEAEFOLIA. VAHL.

1. A. *Arnottianum.* Leaves sprinkled with rigid hairs: peduncles, procumbent, surculose, many flowered: carpels many seeded.—*Plate* No. 3.

2. A. *Wightianum.* Leaves sprinkled with rigid hairs, more abundant on the veins: peduncles an erect scape, terminating in an 8-12 flowered raceme; carpels, by abortion, one seeded.

Both these species are found on the Malabar Coast, the former I also found at Courtallum, where the accompanying drawing was made. They frequent moist shady places in woods, in Courtallum, and under hedges on the banks of wet ditches in Malabar, flowering July and August, perhaps also at other seasons.

SCHUMACHERIA—VAHL NOT SPRINGEL.

Sepals 5 persistent; 2 exterior, 3 interior; estivation imbricative. *Petals* 5 deciduous, hypogynous, alernating with the sepals, two with the margin crisped, estivation imbricate. *Stamens* hypogynous, numerous, all on one side, in several series, monadelphous, all fertile. *Filaments* short, united at the base into a short somewhat flattened androphore. *Anthers* linear, elongated, 2 celled; mucronate at the point. *Torus* none. *Ovaries* 3, free, villous, 1 celled, 1 styled, 1 ovuled. *Ovule* ascending from the base, arilled. *Styles* simple, terminal, filiform, glabrous, during estivation incumbent on the stamens, stigmas simple.

Diffuse climbing shrubs, branches glabrous, round, purplish coloured, the young shoots somewhat flattened. Leaves alternate, coriacious, glabrous, smooth, petioled, exstipulate, repando-serrated, the serratures mucronate, feather-nerved, nerves paralled, simple. Petioles channeled, dilated at the base, half embracing the stalk. Spikes panicled, terminal, and from the axils of the extreme leaves, and equalling them in length. Flowers sessile, secund, bibracteate at the base.

S. *Castaneifolia.*—(Vahl: β *Grahamii* Arnott.) Ceylon in woods near the banks of rivers.—*Plate* No. 4.

In the species here represented the sepals are densely clothed on both sides with appressed shining silky hairs.

Dr. Arnott distinguishes two varieties of this plant, a division which I adopt for the present but not without hesitation, as I think it probable, for the reasons already stated that Vahl's Castaneifolia and Arnott's β Grahamii, will be found different species. It is to me a subject of regret, that Dr. Arnott did not republish Vahl's character and description along with his own, as affording an additional means of determining, by comparing other species, known to exist, with both the old and reformed character.

EXPLANATION OF PLATES.

3d.—DILLENIACEÆ.

1. Acrotrema Arnottianum, natural size.—2. Flower front view, and opened to show the stamens.—3. Calyx, ovaries, and styles.—4. Anthers, back and front view.—5. Side view of an ovary cut vertically, and front view of a carpel full grown, showing the number and pendulous direction of the seeds.—6. A seed with its arillus. All more or less magnified.

4th.—DILLENIACEÆ.

1. Flowering branch of Schumacheria castaneifolia natural size.—2. Flower opened and seen from above, showing calyx, corolla, stamens, and ovaries, all in situ.—3. Stamens removed.—4. Anthers, back and front view.—5. Ovary opened, showing the solitary ovule.—6. Seed and arillus.—7. Immature seed, cut vertically, all more or less magnified. The outline below represents a full grown leaf natural size.

MAGNOLIACEÆ.

In this order a ternary, quaternary or quinary arrangement of the parts of the flower prevails, and both sepals and petals are coloured or petaloid, so as to be almost indistinguishable, and all are equally deciduous, varying in number from 6 to about 30, or more, in several rows, all hypogynous. Stamens numerous, distinct, hypogynous, anthers adnate, long, ovaries numerous, simple, 1-celled, arranged on all sides of an elongated torus, above the stamens, ovules few, or numerous, suspended or erect, styles short, stigmas simple. Fruit consisting of numerous carpels, but varying in their character, being either dry or succulent, dehiscent or indehiscent, distinct or partially conate, arranged on an elongated axis, and sometimes terminated by an elongated point or membranous wing. Seeds solitary, or several attached to the inner edge of the carpel, from which, when ripe, they are often suspended by a long slender umbilical cord, embryo minute, at the base of a fleshy albumen. Trees or shrubs, many of the former of great size, leaves alternate, not dotted, coriacious, entire, distinctly articulated with the stem, with deciduous stipules, which, when young, are rolled together enclosing the leaves like those of Ficus. Flowers large, solitary, many of them strongly odoriferous. Scales of the leaf-bud formed of stipules, either placed face to face or rolled up.

AFFINITIES. This order is nearly allied to *Dilleniaceæ*, from which it is principally distinguished by the petaloid, deciduous sepals, and the predominance of the ternary, not quinary

arrangement of the parts of the flower when few, and by their number when the quinary occurs, also by their spicate, not verticelled ovaries: from anonaceæ, to which they perhaps even more nearly approach, by their stipules, and solid, not ruminated, albumen.

Essential Character. Polypetalous; polyandrous; ovary wholly superior; carpels more or less distinct, leaves furnished with stipules: without transparent dots.*

Geographical Distribution. The species of this order are nearly confined to America and Asia, two or three only having as yet been found in Australia; and none in Africa or Europe. In North America they are most abundant, the woods, swamps, and sides of hills of that country, abounding in species. In India they have a very wide range; extending from the southern provinces of Ceylon and the Peninsula, up to the Himalayas, some of the largest species of the order being natives of the valley of Nepal and neighbouring mountains, while others extending eastward towards China and Japan, ascend as high as the 40° of N. latitude. The species and genera however met with at the extremities of this range differ, *Michelia* being almost the only genus found to the southward, while *Sphenocarpus* and *Manglietia* are conspicuous in the north. There however, several fine species of *Michelia* are also found, four of which have been figured by Dr. Wallich in his Tentanum Flor. Nepalensis, and one in his Plant. Asiat. rariores. Of the known species of the order 14 are enumerated in Wallich's list of Indian plants. Blume has given characters of 11 in his Bijdragen, to these may now be added one from Malabar, one from the Neelgherries, figured by Zenker, the accompanying from the Pulney range of mountains, and three others, of which I possess specimens from the more elevated regions of Ceylon, making up the total number of Asiatic species yet known to about 30, four of which are either indigenous or naturalized in the Peninsula: two of these, are only met with on the highest hills; the third, *M. Rheedii* equally on hills, and on the plains of Malabar; while *Michelia Champaca*, a doubtful native, is cultivated on the plains on account of its fragrant flowers. This predilection of the species for the hills is equally observed in most of the other Indian ones; nearly the whole of those mentioned by Wallich being from Nepal and Silhet. This order therefore in its geographical characteristics though nearly confined to the tropics, or, with one or two exceptions, extending but slightly beyond them, can scarcely be viewed as a tropical order, certainly not to the extent that the Dilleniaceæ are, since the finest and largest of them are natives of hills enjoying a very moderate range of temperature, so moderate indeed, as undoubtedly to bring them within the temperate range, and such as to induce Mr. Royle (Illustrations of the Botany of the Himalayas) to suggest the expediency of introducing several of them into Europe, on account of their great size and value as timber trees—a suggestion, well deserving of attention, and which, it is hoped, will be tried both in Britain and on the continent, as it is one easily made, and considering the unrivalled skill and facilities possessed in Europe for conducting such experiments, very likely to succeed.

Properties and Uses. Bitter and aromatic properties are common to the order, and have led Blume to remark, that by these properties they are known from *Dilleniaceæ*: their flowers are usually fragrant. The fragrance, according to DeCandolle, is such as to produce a decided action on the nerves, that from *Magnolia tripetala* inducing sickness and head-ache; while Barton states, that that from *Magnolia glauca* is so stimulating as to produce paroxysms of fever. The bark of some, though intensely bitter, is devoid of tannin and gallic acid; that of the root of *M. glauca* according to Barton is an important tonic. In this country they seem too little known, to have found their way into the Materia medica of India, at least none of the order are mentioned by either Roxburgh or Ainsley as being employed in medicine, though *Rheede* (Hort. Mal.) in his account of *Michelia Champaca*, (1 tab. 69) does mention the bark of the

* The order *Winteriaceæ* is only distinguished, essentially, from this by the transparent dots of its leaves, and being so closely related, was formerly combined with *Magnoliaceæ*. It is now said, that what all writers have stated about the aromatic stimulant properties of *Magnoliaceæ*, should be applied to *Winteriaceæ*. No species of the order has yet been found in India proper, but *Illicium Anisatum* is a native of China, whence the Indian Bazars are largely supplied with its star-like capsules, possessing, as the name imports, both the fragrance and aromatic carminative properties of the true anise seed; and like it, furnishing to distillation, an essential oil, scarcely, if at all distinguishable from that procured from the European herb. The *Canella alba* or *Winters bark* is procured from a plant of this order, (*Drymis Winteri*) a native of South America. It does not seem probable that if transferred to India the *Drymis* would succeed, but there is every reason to suppose that the star Anise (*Illicium*), might with care be introduced, and prove a valuable acquisition to this country.

root as possessing deobstruent and emenagogue properties. As a perfume and ornament, the flowers are held in general estimation among the Natives. I have not heard of any of the southern species of *Michelia* being esteemed on account of their timber, though several of the Nepal ones afford large and valuable timber. Some of these might, I think, with every prospect of success be transferred to our mountain tracts, and would probably prove both useful and ornamental: in Mysore they might be expected to succeed well, though not equal to what analogy gives us reason to anticipate in the cooler regions of the Neelgherries and Pulneys.

Remarks on the genera and species. In this, as in most other very natural orders, the discrimination of both genera and species is always a task of much difficulty, and until Blume undertook the revision of the genera, of this order, nothing could be more perplexed. His very valuable and costly work, the Flora of Java, I have not an opportunity of consulting, there not being, so far as I am aware, a single copy in Madras, but being very fortunately favoured, through Dr. Arnott, with an abstract of his observations on the order I shall take the liberty of introducing it, which I do, the more readily, as it was prepared with reference to the species here represented.

The generic characters assigned by DeCandolle for the separation of *Magnolia* and *Michelia*, appearing to me involved and unsatisfactory, I requested Dr. A. to supply me with what information he possessed or could procure on the subject: the following is his answer.

" I have looked at different books about the difference between *Magnolia* and *Michelia*, and find the only man who has really made himself master of the subject to be Blume in his Flora Javæ. He has remodelled the genera completely, and does not allow a single *Magnolia* in all East India; the true ones are all American, and are determined by the anthers *extrorse*. Then as to DeCandolle's second section of *Magnoliæ*, about the fruit of which DeC. was ignorant, Blume shows that it is composed of two or three genera, one part of them belongs to *Michelia*, another to *Talauma*, and one to *Manglietia*. He characterizes *Michelia* thus. Petals (*i. e.* petals and sepals combined) 6-15, rarely more, in a ternary or quinary order. Stamens numerous, the anthers anticous. Ovaries numerous, or rarely few, densely spiked but distinct from each other, many ovules. Capsules sub-globose, coriacious, half 2 valved, loosely spiked, many seed, or by abortion 1-2 seeded. To this genus Blume refers all the Asiatic *Magnoliæ* with *axillary* flowers and loosely imbricated fruit, whether the latter contain *few* or many seeds. To these belong *Magnolia fuscata*, *Mag. excelsa* Wall. *Mag. parviflora* DeC. (*Michelia parviflora* De Lessert ic. tab: 85 non DeC.) and several others. His genus *Manglietia*, we have nothing like, but to it belongs *Magnolia insignis* Wall. the ovaries contain many ovules and are concrete, while the capsules are combined into an egg-shaped fruit. A third of Blume's genera is *Aromadendron*, having 28-36 petals, in a quaternary order, ovaries closely combined, 2 ovuled, &c. but that is truly a Java plant—lastly, is *Talauma*, which he has ascertained scarcely to differ from the American species for which Jussien made the genus. Here then are 9-15 petals (or sepals) in a ternary order: Stamens numerous, anthers anticous, ovaries several, *united*, 2 ovuled—Fruit of one mass, strobiliform, woody, irregularly dehiscent. Seeds 1-2, pendulous in the pits of the central, cylindrical, elongated, receptacle; which by the dehiscence is left free; the inflorescence is terminal. To this genus Blume refers *Magnolia pumila* of Springel (excluding synonyms) *Magnolia pumila* Andr. and DeCandolle, *Magnolia Rumphii* Spr. (excl. syn. Linn.) or Rumph. 2 tab. 69 &c. under his *Talauma pumila* (or *Magnolia pumila* Andr.) he quotes (like DeCandolle) *Guillimia Indica* Rottl: which Rottler says he found in the continent of India. Now a question here arises, can Rottler's plant have been cultivated? or wild? The only information I can get on that, is that in Curtis' Magazine, where, at t. 977, *Magnolia pumila* is figured, it is said " we have been informed that some botanists in Madras considering this plant a new genus named it *Guillimia*, in honor of Lady Gwillim, the patroness of science in that presidency." But there it is said to be from China. Now if Rottler's plant came from China, then it may be the true *Talauma pumila*, but if it came from the Peninsula, then I suspect it to be your *Magnolia*, probably the same as that given by Zenker as *Michelia nilagirica;* and also the same as Colonel Walker and you have from Ceylon. At all events whatever Rottler's be, yours, Zenker's, and Walker's, have *axillary inflorescence*, and more than two ovules in each ovary, and carpels splitting down the middle so as to be half 2-valved, and are unquestionably *Michelia*.

This exposition of the characters of the genera of this order leaves no room to doubt, that the plant have figured is a true *Michelia*.

The genus *Michelia* under Blume's amended and simplified character, is one of easy recognition, but the determination of the species, owing to the great accession which has been made to their number, is now most difficult, not so much, perhaps, from their not affording adequate discriminating marks, as from their never having been subjected to a sufficiently comprehensive scrutiny to admit of their proper characters being elicited, by a careful comparison of one with another. Nor indeed is this to be wondered at, when we consider how seldom opportunities occur of examining them in their native places, and how few have yet found their way into cultivation. It is not without feelings of regret that I find myself forced, from the imperfection of my materials, to leave this task to another, or at all events to postpone the examination until some future opportunity, as the very few species of which I possess specimens, barely enables me to conjecture, what series of organs are most likely to furnish either good specific marks or sectional subdivisions. For the latter purpose the number of spathes or bracts enveloping the young flower bud may prove serviceable, namely, whether two or three. For example, in M. *Champaca*, there are two, one exterior, and early caducous, which, (for convenience) I call bractial, and one closely embracing the flower, which (for the same reason) I call calycine, while in M. *Pulneyensis* there are three, one bractial and two calycine. The number of petals will perhaps be found to furnish another set of good characters, though for the present that seems doubtful; but the number in each verticel whether 3, 4, or 5, promises to afford excellent sectional characters, since it may be presumed, that that series of numbers will be constant in each species. These structural differences, aided by variations in the forms and surfaces of the leaves; whether rough or smooth, glabrous or clothed; the colour, kind, and degree of clothing, of the spathes; the form, size, colour, and whether smooth or warty, of the carpels; and lastly, the number of seeds in each compared with the ovules, ought I think, to present such a combination of easily recognizable characters, as should leave but little difficulty in distinguishing a much more extended series of species, than we have any reason to believe appertains to this genus.

To what extent these hints for the discrimination of species will be found to avail in practice, it is difficult to say, but it seems desirable that they should speedily be brought to the test of experience, since there is no genus, of the same extent, in which it is so difficult to determine the species. Much attention, and the examination of numerous specimens will no doubt be required towards the determination of the value of characters taken from the corolla, but those taken from the spathes and fruit, will, I suspect, be more steady, and, by so much, more valuable, at the same time, that they are more easily ascertained.

Adopting the number of spathes as a sectional character in the manner mentioned above, the following distribution of species into two leading sections, will probably be found correct.

1st. *Flower buds with one bractial and one calycine spathe.*

M. Champaca, *M. excelsa*, *M. Doltsopa*, *M. Kisopa*, *M. aurantiaca*, *M. fuscata*, *M. nilagirica?* and three undescribed species in my herbarum from Ceylon.

2d. *With one bractial and two calycine spathes.*

M. Pulneyensis, *M. lanuginosa* (?) and perhaps some of the *Magnoliæ* of DeCandolle's second section, which are referable to this genus.

The Nepal species with the exception of the last, I have referred to the first section on the authority of the following passage in Wallich's Tentamen Fl. Nepalensis, " they (the flower buds) are enveloped in two entire membranous rounded spathes, the outer one much sooner caducous than that within." Such is the case with the outer or bractial spathe of *M. Pulneyensis*, while the two interior ones seem to separate about the same time. *M. lanuginosa*, I have doubtfully referred to the second section, owing to two bracts being represented in the figure as if caducous about the same time; while in the others, one only is figured. Should the sectional characters I have proposed be found applicable to all the species I have respectively referred to them, there can be no doubt of my plant being distinct from all, unless it should be found that *M. nilagirica* is incorrectly described, which I fear is the case, though from never having seen specimens, I do not feel myself at liberty to offer any opinion on the subject. I may here observe that the cluster of fruit represented in my figure does not belong to the true *M. Pulneyensis*, but to a new and distinct species, (namely, *M. Rheedii* of this work,) and

was, I now think rather unfortunately, introduced, merely as an example of the fruit of the genus. To prevent confusion however, I shall in a future number, publish a figure of an entire specimen, such as I found them.

The following synopsis of Indian species of *Michelia*, arranged on the principles above explained, though probably far from correct, is offered, in the hope that it may prove useful to those who may have opportunities of examining recent specimens, by directing attention to those points whence it seems probable, good characters may be derived, and thereby enable them to draw up such descriptions as will furnish botanists with the materials required to define, with precision, the species of this hitherto most difficult genus. The want of specimens or figures of the Eastern forms, prevents my attempting to introduce any of them.

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§ 1. *One bractial and one calycine spathe.*

A. *Petals numerous,* (12-15) *in a ternary or quinary order.*

1. M. *Champaca,* Leaves ovate, oblong, much acuminated, acute at the base, the midrib beneath, petiols, peduncles and spathes, silky—*Blume.*

Leaves lanciolate, glabrous—*D. C.*

Leaves lanciolate—*Lin. Willd. Persoon.*

Such are the brief and vague characters assigned to this species; hence it is not to be wondered at, that the habitation allowed is equally vague and unlimited; namely, the whole of India and the Eastern Archipelago. As synonyms, DeCandolle quotes Rumphius, *Herb. Amboynense* 2—tab. 67, and Rheede *Hort. Mal.* 1 tab. 19; which, judging from the figures and the descriptions are, I think, different plants.

According to Rumphius's figure, the leaves are ovate lanciolate, tapering to a slender point, and are described as "being a span long, and two inches broad," (agreeing so far with Blume's character) the flowers have 15 petals, ranged in three rows, or in a quinary order, the five exterior ones smaller than the middle row, while the interior are much smaller than either; and lastly, the stamens are described as numerous, short and thick, bearing *roundish anthers*; a peculiarity, which at once separates it from all continental Indian species. Rheede's description is less explicit, but still such as to afford good grounds for separating his from the Amboyna plant. The leaves, according to the figure, are elliptic, much acuminated, and attenuated at the base, until they imperceptibly pass into the petiol. The petals are said to be in verticels of eight, indicating a quaternery order, (thus associating it with Wallich's *M. excelsa*) the inner row passing into stamens; which are said to be cuspidate, as in the other Indian species. The fruit are differently represented by each, but by neither well; but Rheede describes the ovaries of his plant as terminating in a circular scutelliform point; a very unusual appearance in the genus, but which, I have ascertained to exist in the ovaries of the fruit represented in my plate, and from which I infer that that spike presents a correct figure of the fruit of Rheede's plant. This therefore I propose separating from Rumphius' plant as a new and distinct species, to be afterwards defined in its, presumed, proper place, under the name of *M. Rheedii.* Whether Blume and Rumphius describe the same plant, I leave to eastern botanists to determine, as I have seen neither.

2. M. *Doltsopa.* (Wall. Tent. Fl. Nep.) Leaves elliptic-oblong, much acuminated, slightly pubescent beneath, long petioled: stipules and spathes clothed with rusty coloured pubescence: petals 15, arranged in quinary verticels, sub-pubescent, mixed with minute spots at the base: styles short, recurved, very papillose.

Woods of the valleys and lower hills of Nepal—Wall. The fruit is neither described nor figured.

I have adopted Wallich's figure and description in this and the following, for the type of these species, as he seems to have no doubt of the identity of his plants, and those of Buchanan Hamilton, and DeCandolle.

3. M. *Kisopa.* (Wall. l. c.) Leaves ovate, lanciolate, acuminated, coriacious, glabrous: stipules and spathes villous, whitish, the last very obtuse: petals 12 (ternary?) nearly equal, acute: ovaries villous: styles longish, recurved: carpels remote, smooth, sub-globose, contracted at the base as if pedicelled, not verrucose, three or four seeded: seeds enclosed in red pulp.

Found in many of the woods of Nepal—Wall.

The rachis of the fruit is represented as branched: this must surely be a very unusual occurrence, yet it is not alluded to in the description, which merely mentions the spike as being tortuous. It is perhaps attributable to an error of the draughtsman, who has taken that method of representing a tortuous spike. The carpels of this species are too smooth, and free from warty inequalities on their surface, to admit of this being associated with my *M. Rheedii.*

4. M. *aurantiaca* (Wall. Plant. Asiat. Rar. 2. 39 tab. 147) Young shoots, petiols, and peduncles, hairy: leaves ovate, oblong, ending in a long attenuated acumen, acute at the base, pubescent beneath: stipules and spathes, clothed with greenish brown pubescence: petals numerous (20) in a quinary order, (orange coloured) stamens numerous, sessile, much shorter than the column of fructification: ovaries densely congested, ovate: styles recurved: ovules—fruit—

Pegu near Rangoon, flowering in September—Wall.

5. M. *Walkerii.* Young shoots villous, leaves elliptic, lanciolate, acuminated, acute at the base, glabrous, except the young ones which are clothed beneath with silky pubescence: stipules and spathes silky: petals about 12, narrow, lanciolate, pointed: stamens numerous, mucronate, equalling or exceeding the colums of fructification, half the length of the petals: ovaries 2 ovuled: carpels globose, one seeded, slightly warted.

Ceylon in woods, Nuera Ellia, flowering in March and April. First communicated by Colonel Walker, and afterwards gathered by myself.

A large shrub or small tree, the smaller leaves towards the ends of the branches, narrow, lanciolate, the larger ones elliptic, oblong, coriacious, 2½ to 3 inches long, and one broad, short petioled.

B. *Petals few* (6-9) *in a ternary order.*

6. M. *ovalifolia.* (R. W.) Glabrous, leaves elliptic, broader towards the point, abruptly and shortly acuminated, acute, passing imperceptibly into the petiol, at the base: stipules and spathes clothed with stiff short appressed shining hairs: petals 6, spreading, obovate, obtuse: stamens numerous, nearly sessile, mucronate, shorter than the column of fructification; ovaries few, three ovuled, style curved at the point, equalling the ovaries: fruit—

Native of Ceylon whence my specimens were communicated by Colonel Walker.

Apparently a shrub, with smallish (3 or 3½ inches long, by 1½ broad) coriacacious leaves flowers, large in proportion, petals 4 or 5 times the length of the stamens and column, ovaries, as in all the other species I have examined, clothed with whitish hair.

7. M. *glauca.* (R. W.) Very ramous; branches rigid, short, glabrous, except the extreme shoots: leaves glaucous beneath, obovate, much attenuated towards the base, ending in a short blunt acumen: stipules and spathes whitish, silky, petals 6, spreading, obovate: stamens numerous; filaments nearly equalling the short anthers, which together, scarcely exceed the pedicel of the column of fructification, and are about six times shorter than the petals: ovaries numerous, densely congested towards the point of the column: styles recurved at the point only: fruit—

A native of Ceylon, where it was found by Colonel Walker, who communicated specimens, but without fruit.

This like the other Ceylon species, judging from specimens only, has more the appearance of a shrub than a tree: the leaves rarely exceed an inch and half in length, and are nearly as much in breadth across the broadest part, near the point, these are borne, two or three together; on the extremities of numerous short rigid branches. The most distinctive mark however of the species is, the short anthers in proportion to the filaments. Generally the anthers are three or four times the length of the filaments, but here, they scarcely exceed that standard, and then both barely equal the length of the elongated pedicel of the ovarial column.

C. *Petals in a quaternery order.*

8. M. *excelsa.* (Blume. Magnolia excelsa Wall. Tent. Fl. Nepal). Leaves oblong, elliptic, acuminated, glaucous beneath, stipules and spathes, tomentose, deep rusty brown coloured, petals 12 in a treble series, (quaternery) stamens numerous, one third the length of the petals, filaments very short: ovaries, small, 4 ovuled: carpels, sub-globose, small, warty, one seeded; seed enclosed in red fleshy pulp.

Nepal.—Sheapore hill at an elevation of about 7000 feet above the sea. Flowering in March—fruit ripe in October—Wall.

This magnificent tree attains the height of from 50 to 80 feet, and is most remarkably limited in its station being, Dr. Wallich informs us, confined to a single spot on mount Sheapore. The wood is highly prized by the natives of Nepal, where it is sold under the name of Champ.

? 9. M. *Rheedii.* (R. W.) Arborious, glabrous: leaves elliptic, oblong, acuminated, attenuated at the base: flowers many petaled, (about 20) in a quaternery (?) order, the outer series the largest, obtuse, the interior ones cuspidate: ovarics numerous, congested; styles caducous, leaving a smooth, circular, shield-like scar on the apex: ovales numerous (10-12): carpels large, approximated, rough, marked with numerous prominent warts, about four seeded; seeds triangular, testa hard, black, enveloped in red fleshy pulp.

Champacam Rheede Hort. Mal. 1. tab. 19. *M. Champaca* partly Lin. Willd. DeCandolle, not Blume.

A native of Malabar and the more elevated hills of the Peninsula, Pulney mountains at an elevation of about 5000 *feet. Shevaroy hills* 4500—*on both of which I gathered specimens.*

I am enabled by means of cultivated specimens of the Champaca, which correspond in almost every particular with Blume's character, so far as it goes, to separate this species, though on characters less precise and satisfactory than I could have wished, owing to my specimens not being in flower. The ovaries and carpels afford, in the present state of our knowledge, the best distinctive characters, the polished shield-like the ovaries is very characteristic, while the large prominent warts of the carpels are scarcely less so.

? 10. M. *nilagirica.* (Zenker) Leaves elliptic, glabrous, acuminated, acute at the base: stipules and spathes silky: petals 8 in two verticels: stamens shorter than the column of fructification: ovaries numerous, 1-ovuled: carpels one seeded, warty.

Neelgherries in woods. Flowers white.

This species associates in so many points with my plant, that I suspect a more careful examination will unite them. The points of difference are, that in M. *nilagirica,* the spathes are described as single in place of double, the corolla as 8 petaled, ranged in quaternery series, 4 and 4, in place of 6-9 in ternary order, and lastly, as having ovaries with solitary ovules, in place 4 in each.

§ 2. *One bractial and two calycine spathes.*

11. M. *Pulneyensis.* (R. W.) Glabrous, leaves elliptic, or sub-obovate, acuminated, acute at the base: stipules and spathes, clothed with silky appressed hairs: petals 6-9, ranged in ternary order, exterior ones obovate, interior when nine, lanciolate: stamens numerous mucronate, nearly equalling the column of fructification: ovaries numerous, 4-ovuled: fruit—

Woods, Pulney mountains at an elevation of 6000 *feet, flowering in September.*

A handsome, tall, straight, tree, with ascending scarcely spreading branches. The leaves vary in their form, being elliptic in some and passing into obovate in others, coriacious, glabrous. Peduncles shorter than the pctiols, thick, hairy, marked with two rings, where the spathes have separated, stamens numerous, caducous, except two, which often remain, long after the others, attached to the middle pedicel, ovaries numerous, ovules, very constantly, four, suspended.

? M. *Lanuginosa.* (Wall. Tent. Fl. Nepal.) Every where clothed with greyish woolly pubescence: leaves oval, obtusely acuminated, slightly attenuated and acute at the base: stipules and spathes, tomentose; petals about 12 in a ternary (?) order: column of fructification nearly twice the length of the stamens: ovaries numerous, carpels sub-globose, 2 or 3 seeded.

Woods of Nepal, flowering in April and May.

This species is readily distinguished by being every where clothed with woolly pubescence. As already observed I have referred it doubtfully to this section, on account of its supposed double spathe, two being figured, and mentioned in the description.

EXPLANATION OF PLATE.

5th.—MAGNOLIACEÆ.

1 and 6.—1. Flowering branch of Michelia Pulneyensis, and 6, spike of ripe fruit of M. Rheedii, natural size.—2. Flower bud, the exterior, or bractial spathe removed, and showing the 2 calycine spathes ready to drop off.—3. Torus, stamens, and column of fructification.—4. Anther, front view.—5. Ovary, entire, and cut vertically, to show the pendulous ovules.—7. 8. Seeds, entire, and cut transversely, all more or less magnified. —9. Seed, natural size, covered with pulp, and 10 (by mistake also 9) the same (the pulp removed) somewhat magnified to show its triangular form.

Rungia del

MICHELIA PULNEYENSIS R.W.

செம்புகமரம்
Shem bee ga marum.

ANONACEÆ.

This large, and truly tropical, order, is composed entirely of trees or shrubs, (no herbaceous member has as yet been found appertaining to it) with alternate, simple, entire, ex-stipulate, often fragrant, leaves; and hermaphrodite, except in *Hyalostemma*, (Wall.) regular, axillary flowers. These are usually pale, or dull yellowish green, or brown, but sometimes yellow, and in *Uvaria grandiflora* are rich crimson, for the most part axillary, solitary, or a few together; but in *Guatteria longifolia* they form large clusters; in *Artabotris*, they spring from curiously hooked grapples, or tendrils, apparently abortive branches.

The calyx is generally deeply three parted; or rather perhaps, consists of three distinct sepals, partly united at the base; where they are very broad. The corolla consists of six petals, in a double series, three and three, often unequal; sometimes the exterior, sometimes the interior series, being much larger than the others; all caducous. The stamens are usually very numerous, sessile, and closely cover the whole of the enlarged, somewhat globose torus, rarely definite as in *Bocagea*: the anthers are two-celled, lateral, opening outwardly, and surmounted by an elongation of the connective, sometimes pointed, but oftener flattened, and truncated, more rarely they are adnate, as in *Miliusa*, a peculiarity which, when it occurs, promises to afford a useful generic distinction. The ovaries are generally numerous, one-celled, congested on the apex of the prominent torus, either free or united: ovules few or numerous, variously attached; being either numerous and transverse, springing in a double row from the inner angle of the cell in *Uvaria*; or solitary, and erect, and from the bottom of the cell in *Guatteria*; or pendulous from the top of the cell in *Orophea*. Style usually short or wanting, stigma capitate. The fruit is apparently more variable in its character than the other parts of the fructification, and has hitherto been almost entirely looked to for generic distinctions. In some, it consists of numerous, united, one-seeded, carpels, enveloped in soft pulp, and forming together a pulpy fruit, as in *Anona*; (the custard-apple, sour sop, and bullock's heart) in others, the carpels have one or several seeds, and are borne on a long peduncle, as in *Uvaria*, *Guatteria*, &c. and sometimes these carpels though otherwise distinct, remain sessile, or with the peduncles so short that the carpels form together a globose head: (this variation occurs in some species of *Uvaria*, and *Miliusa*.) In others, as *Unona*, the carpels are elongated, containing several seeds, and contracted between them like a necklace of beads. The seeds universally possess the remarkable character of having ruminated albumen, like those of the nutmeg. A few have them arilled as in that genus, which (aril) when it exists, is supposed to secrete at the base of the seeds, a resinous highly aromatic matter. This is the case in what is called the Ethiopian pepper, (*Habzelia Ethiopica*) and some others, which, partly on that account, the younger DeCandolle has united to form the genus *Habzelia*, a genus common to both Africa, and America, but not yet found in Asia.

Affinities. The affinities of *Anonaceæ* are so various, as not to be easily indicated in a few words, but their closest alliance is certainly with *Magnoliaceæ*, from which however, they are readily distinguished, by their ex-stipulate leaves, their more distinctly formed, and sub-persistent calyx, by the form of their anthers, the arrangement of their ovaries, but above all by their ruminated albumen. This last character however, combined with the ternary arrangement of their flowers, the occasional presence of an aril, and their aromatic properties, so closely associates them with *Myrsticaceæ*, (the nutmeg tribe) that Professor Lindley seems to consider the latter, as little else than an apetalous form of *Anonaceæ*. Thus constituted, it is difficult to give an abridged character of the order, but as, generally speaking, the Indian species present the normal forms, their character may be summed up in the following terms.

Essential Character. Polypetalous, polyandrous, ovaries wholly superior: carpels more or less distinct: very rarely solitary: seeds, usually without an aril, albumen aromatic, ruminated. Leaves alternate, ex-stipulate. In one Indian genus (*Hyalostemma*) the flowers are diæcious.

Geographical Distribution. This, as already remarked, is strictly speaking, a tropical order, confined to Asia, Africa, and America, none having as yet been found in Europe, or Austra-

lia, and very few beyond the 30th degree of latitude. In 1832, when Alphonse DeCandolle published his memoir on this family, he reckoned 204 as the total number of species, of these 87 are Asiatic, 95 American, and 22 or 23 African. He thinks, however, that the relative proportion of the *Anonaceæ*, to the total vegetation, is nearly the same in all equatorial regions. In 1818, the number of known species amounted to 105, hence in the short interval of 14 years, the number of species was doubled, and several have since been added. Dr. Wallich enumerates about 80 Indian species, to these one or two were added by Mr. Arnott and myself, and several other peninsular species, have been recently discovered in the course of my excursions: doubtless, many yet remain in our jungles, especially in those tracts of hilly country, enjoying a moist climate, with a moderate range of temperature. From this I infer, that when such localities have been more carefully examined, the Indian list will be found to exceed 100 species; which I consider the more probable, as I observed at Courtallum, where I found the greatest number, that they always occupied the thickest woods, and being themselves, generally of a very plain, and unostentatious aspect, with small flowers, are apt to be passed unnoticed. In proof of the correctness of this opinion, I believe it is only necessary to add, that when DeCandolle and Dunal wrote, the number of known, Indian species, amounted to only thirteen.

Properties and Uses. Like most other tropical orders, the properties and uses of *Anonaceæ*, are imperfectly known to Europeans; and in this country at least, a very few have as yet been admitted into cultivation, though some of them are sufficiently ornamental. For their fruit, three species of *Anona*, are cultivated in India, *A. squamosa*, (custard-apple) *A. reticulata*, (bullock's heart) and *A. muricata*, (sour sop). This last I have not myself seen in India, but being the *A. asiatica* of Linnæus, must have been one of the first introduced.

The *Guatteria longifolia* (or *Asochum*) is commonly cultivated about Madras, and some other places, as an ornamental tree; a distinction to which its elegant form justly entitles it, but its wood is said to be soft, and of little use. *Artabotris ordoratissima*, a diffuse shrub, with exceedingly fragrant flowers, springing from a curious hook, or grapple, is occasionally, though too rarely, cultivated as an ornamental shrub, which it well merits. These, to the best of my recollection, are the only members of this order, I have met with in cultivation. Many others both of Indian, and Exotic origin, might however be brought, with advantage, into our gardens. The *Uvaria grandiflora*, a superb plant, a native both of Sumatra, and Ceylon, which has succeeded well in the Calcutta botanic garden, has large showy bright crimson flowers. *Uvaria narum* the one represented here, might also form a desirable addition to the few ornamental shrubs, we possess. *Guatteria virgata*, (the lancewood of Jamaica) the wood of which is highly esteemed in England, on account of its strength, and elasticity, might form a very useful addition to our stock of woods, suited for the operations of the coachmaker.

Most species of *Anonaceæ* are remarkable for their fragrance; and for their aromatic properties, diffused through every part of the plant. The roots of the *Uvaria narum* enjoy these properties in a high degree; and are, we are informed by Rheede, much employed in Malabar, in the cure of a variety of diseases. He states that the infusion of them, is successfully administered in some forms of fever, and hepatic disease; that bruised in saltwater and rubbed on the skin, they cure the *morbus pedicularis*, originating in general weakness. This property of destroying vermin, is equally enjoyed by the seeds of the custard-apple, which, we are informed, by Mr. Royle, are, in Bengal, powdered and mixed with flour of Bengal gram, (*Cicer Arietinum*) and used to wash the hair for the purpose of destroying these unwelcome intruders. Contrary to the usual character of the tribe, the leaves of the custard-apple have a heavy disagreeable smell. Upon the whole I think it may be safely asserted, that rich as India is, in species of this order, we as yet know very little of their useful properties, and judging from analogy, it may with equal safety be asserted, that they should be carefully inquired into. For example, we already know that most of the species, of *Habzelia*, natives of both Africa, and America, are highly aromatic, and that the seed of one, or more of them, forms a considerable article of commerce, under the name of Ethiopian pepper. In *Xylopia*, (Bitter wood, so called from the taste of the wood) a West Indian genus, the bitter principle so universally prevails, that every part of the plants possess it. In *X. glabra* " the wood, bark, and berries, have an agreeable bitter taste, not unlike that of the orange seed. The wild pigeons feed much on the latter, and owe that delicate bitterish flavour, so peculiar to them in the season, wholly to this part of their food.

Fresh gathered from the tree, they are agreeable to the palate, and grateful to the stomach. The bark is also richly impregnated with this juice, as well as the wood, and both yield a very agreeable bitter in the mouth while fresh ; but that diminishes greatly after they are dried.

The bitter quality of this tree is communicated with great facility. A handful of the shavings immersed in water, and instantly taken out again, will render it of a very bitter taste. Sugar sent over in hogsheads made of this wood, was so bitter that no person would purchase it. Bedsteads, and presses made of it are proof against cockroaches and other insects."* A decoction of it is said to create appetite, and possess the usual tonic properties of bitters. These examples are I presume, sufficient to establish the value of the properties inherent in members of this family, and go far to prove, that among the numerous Indian species belonging to it, we have good reason to expect, some, when properly investigated, will be found not less valuable, than the better known American and African ones.

Remarks on the Genera, &c. Of this order Dr. Roxburgh, in his Flora Indica, gives characters of 27 species, classed under three genera, namely, *Anona, Uvaria,* and *Unona ; Guatteria,* was afterwards added to the catalogue, of Indian genera, by referring several of Roxburgh's Uvaria's to that genus. These genera were distinguished by characters almost entirely taken from the fruit, without reference to the ovary, or indeed to any other part: *Anona,* being distinguished by having a number of carpels, united into a single compound fruit: *Uvaria,* by having its carpels distinct, stipitate, fleshy, many-celled, and many seeded ; with the seeds ranged in two rows: *Unona,* by having distinct, but dry, many-seeded, carpels ; the seeds ranged in a single row, and often resembling, by the contraction of the carpel between them, a necklace: *Guatteria,* by having dry, globose, stipitate, one-seeded, carpels. These simple, and, at first sight, apparently all-sufficient characters, were found on more careful examination to be exceedingly incorrect. *Uvaria,* for example, to which was attributed a many-celled fruit, and two rows of seed, was found to have a one-celled ovary, and the rows of ovules, if two, so close as scarcely to be distinguishable, and in truth forming a single line attached to the inner angle ; hence the many cells, and two rows of seed observed in the mature carpel, must be produced by mere condensation of the surrounding pulp, and the divergence of the free extremities, of the seed, since they are all attached along the same angle of the seed vessel. In *Unona,* the structure of the ovary is the same, with probably fewer ovules, hence it follows, that the abortion of a few ovules (by leaving more room for the regular development of the remainder) may convert a *Uvaria,* into a *Unona;* and *vice versa,* an unusual number of ovules, or any hindrance to the usual course of development of the seed vessel, might equally change *Unona,* into *Uvaria ;* the differences between the two genera, thus rest on adventitious, not structural, differences. In support of the justice of this position, it is only necessary to state, that a large proportion of the species of the latter genus, have, since the publication of DeCandolle's *systema,* been removed to the former. The propriety therefore, nay, the necessity, of uniting the species of both, and of two American genera, having similar ovaries and fruit, (*Asimia* and *Porcilia*) into one genus, as ably advocated by M. Richard, in some remarks on the subject in the *Flore Senegambie,* becomes evident. Blume, however, as appears from DeCandolle's memoir, has revised the character of *Uvaria,* and still keeps them distinct ; but as I have not his work to consult, I am unable to state with what propriety. *Guatteria,* which in like manner is characterized from the mature fruit, without reference to the ovary, may be simulated by species of *Uvaria,* or *Unona,* through the abortion of all the ovules but one, a modification of which my collection presents specimens.

Swayed by these facts, M. Richard proposes an amended character for *Uvaria,* in which the one-celled, many ovuled ovaries, with the ovules attached along the inner angle, forms the essential distinction ; a modification which admits of the association of all the species now referred, to the four genera above named. The character of *Guatteria,* might be similarly modified with advantage, and would then, perhaps, be found to separate the American, from the Indian, division of the genus. All the Indian ones I have yet examined have a single, erect, ovule, attached to the bottom of the ovary. Whether or not the American species referred to this genus, possess this structure, I am unable to say, but in the following Indian ones, I have

* Loudon's Encyclopædia of Plants, Art. Xylopia.

ascertained it to exist. *Guatteria longifolia, Korinti, cerasoides*, and *suberosa*. By this addition to the character, all *Anonaceæ*, with single seeded carpels, but having more than one ovule, or even with one ovule pendulous, or attached to the inner angle, and placed transversely across the cell of the ovary, will be excluded. In combination with this structure of the ovary, I have in all the above instances, found the petals nearly equal, and the connectivum of the stamens truncated, that is, prolonged beyond the anthers, and ending in a broad shield-like apex.

Four other genera have more recently been added, to the peninsular flora. *Artobotris*, Brown, *Miliusa*, Alph. DeCandolle, *Lobocarpus*, Wight and Arnott, and *Orophea*, Blume. The first of these is well known: the second is described, and figured, by the younger DeCandolle, in a memoir in the Geneva, Natural History Society's, Memoirs, but apparently from very imperfect specimens, since his character differs in some essential points, from numerous specimens, I have collected since my return to India, and most of them from the same station, from which his was procured, namely, Courtallum. DeCandolle assigns to his, 3 sepals, and 3 petals, united half their length, and forming a bell-shaped corolla, at the base, that is two series of verticels. In mine, there are invariably three verticels, the two outer ones much smaller, both hairy, and sepaloid, in aspect, giving it the appearance of having 6, in place of 3 sepals, and a 3-petaled corolla: while the stamens are represented by DeCandolle as only 12 in number, and placed in a single series, round the elevated torus on which the ovaries are borne, while in mine, I have always found them, as in most of the other members of the order, numerous, closely covering the whole of the torus, and nearly sessile, in place of being furnished with a distinct longish filament. I think I have now two species of this genus, one of which, in spite of these discrepancies, I consider the same as DeCandolle's. *Lobocarpus*, I have not again met with, and have nothing to add, to what is contained in my flora. *Orophea*, which I lately found at Courtallum, in dense thickets, is a handsome shrub, but with small inconspicuous flowers. It is readily distinguished by having the inner, series of petals, much larger than the outer, and attenuated at the base, into a distinct claw or unquis. The stamens are in a double? series about 15, and have the appearance of being 4-celled, from a depression along the line of dehiscence. Ovaries with 2 pendulous ovules, and furnished with a large style. Some other, perhaps new genera and species, of which I have specimens, remain to be added, but as I have not yet been able to ascertain, whether or not they are already named, I forbear for the present, characterizing them, as it is my intention, so soon as leisure permits, to re-examine the whole series, and figure, and describe all those that are new, or but imperfectly known. One however, of these genera, of which I possess two species, both from Ceylon, distinguished by some unusual peculiarities, is too interesting to be passed over in silence on the present occasion.

In the form of the corolla and torus. this genus associates with *Cœlocline*, but differs so widely in the character of its ovaries and fruit, as leaves me no room to doubt its being new and perfectly distinct. The most remarkable peculiarities observed in the course of my, perhaps too hurried, examination, were—1st. The calyx is persistent, the sepals united to near the apex, enlarging with, and enclosing, the fruit.—2d. The torus is concave, prolonged beyond the ovaries, bearing the stamens exteriorly, and the ovaries within.—3d. The ovaries are indefinite, few (one?) ovuled, with the ovules attached near the apex, and pendulous.—4th. The styles are long, subulate, ending in a simple acute stigma.—5th. The carpels are one-seeded, united into a single fruit, enclosed within the enlarged calyx, and ranged in a single row, round the central axis, with the solitary compressed seeds, pendulous from the apex. The fruit, in my specimens, is not quite mature, but is sufficiently advanced to enable me to ascertain these points. This genus may therefore be thus characterized.

Patonia, R. W.

Sepals 3, united at the base, persistent, enlarging with the fruit. Petals, in a double series, distinct. Stamens numerous, distinct, truncated at the apex. Torus concave, bearing stamens externally, and ovaries within. Ovaries free: ovules solitary, (?) pendulous from the apex. Style longish, subulate. Stigma acute. Carpels numerous, (10-15) all united, enclosed within the enlarged tubular calyx. Seeds solitary, compressed, pendulous from the apex of the carpel. Trees or shrubs: leaves oblong, lanciolate, acuminated, glabrous: flowers axillary, solitary, or several together, from a short peduncle, or abortive branch: corolla slender; petals tapering towards the point, pubescent: fruit, concealed within the tube of the greatly enlarged, 3-lobed calyx.

This genus is dedicated to Miss Paton, now Mrs. Colonel Walker. The name *Walkeria* being pre-occupied, prevents me dedicating it to my highly esteemed and amiable friend, under the name by which only she is known to science, as the diligent and acute investiga-

Bunge. del. R. W. lith.

UVARIA NARUM.

tor, and, not less graphic than persevering, delineator, of the plants of Ceylon.

1. P. *Walkerii* (R. W.) Leaves glabrous, oblong-lanciolate, acuminated: lobes of the calyx, acute in flower, obtuse in fruit: corolla somewhat ventricose.—*Hab. Ceylon, in woods: communicated by Colonel Walker.*

The leaves are about 6 inches long, by 2 broad, with a long acumen, shortly attenuated at the base, glabrous on both sides. The corolla is somewhat ventricose in the middle, contracted within the calyx, and towards the point; lobes of the calyx very acute, and reaching to the dilated portion of the corolla, as the fruit advances, becoming broad, obtuse, and reflexed at the point.

2. P. *parvifolia* (R. W.) Leaves lanciolate, acuminated, glabrous: lobes of the calyx broad, very obtuse, hairy: corolla gibbous at the base, attenuated upwards, tomentose: fruit —

Hab. Ceylon, communicated by Colonel Walker.

A shrub with glabrous, lanciolate, acuminated, leaves; from $1\frac{1}{2}$ to 2 inches long, and about $\frac{3}{4}$ broad. Corolla very gibbous, or sub-globose, at the base, and thence attenuated to a point. Calyx lobes, broad, obtuse, shorter than the dilated portion of the corolla. The fruit of this species is still unknown, hence it may possibly prove a species of *Cælocline.*

EXPLANATION OF PLATE 6.

1. Flowering branch of *Uvaria Narum.*—4. Peduncle, and cluster of full-grown, stalked, carpels.—*Natural size.*

2. Sepals, stamens, and ovaries.

3. Flower, cut vertically, showing the ovaries and stamens on the prominent torus.

5, 6. Back and front view of the stamens.—7. Ovary detached.—8, 9. The same cut transversely, and longitudinally, showing the position of the ovaries.—10, 11. A carpel cut transversely, and longitudinally, showing the position of the seeds, and the spurious cells of the fruit.—12. A seed.—13. The same cut vertically, to show the ruminated albumen—*all more or less magnified.*

V.—MENISPERMACEÆ.

This is a small tropical order, consisting for the most part of twining shrubs, with alternate, usually entire, ex-stipulate, leaves; and numerous, small, flowers. The flowers are unsexual, and usually diæcious, consisting of one or several rows of sepals, (Lindley) or of sepals and petals, according to other authors, each row, having from three to four parts. The stamens are either distinct, each opposite a petal, as in *Cocculus,* or they are few and united, forming, in *Cissampelos* and *Clypea,* a small antheriferous disk in the centre of the flower, or they are numerous, and united, forming in *Anamirta,* (the *cocculus indicus* of commerce) a round head. Anthers, either erect, proceeding from the point of the filament, or adnate, and attached transversely across it, as in *Cissampelos.* Ovaries, usually several, free, or but slightly united at the base, one-celled, with a solitary, pendulous, ovule, attached, by the middle, to the angle of the cell. Drupes, usually berried, one-seeded, oblique, compressed; the seed of the same shape as the fruit. Embryo curved in the direction of the circumference. Albumen thin and fleshy, rarely none. Radical superior, " but its position sometimes obscured by the curvature of the seed" (Lindley.)

Several, perhaps all the species, of the genus *Cocculus* are so remarkably tenacious of life, that if even a large branch be broken, at a considerable distance from the ground, the upper portion, immediately throws out a slender filiform root, which speedily re-establishes the connexion with the soil, and preserves the plant. I have seen such a root eight feet long, and not thicker throughout than a common pack thread.

Affinities. It is difficult in the present state of the science to state the affinities of this order. Hitherto they have been supposed nearly allied to *Anonaceæ* and *Berberideæ,* and are placed in nearly all modern systems of Botany between these orders, a view in which Dr. Lindley, and as it appears to me, with good reason, cannot coincide. The following extract will explain his grounds of dissent, at the same time that it exhibits, while canvassing them, the ideas of those who take a different view.

" It is usual to refer the species of this alliance to *Polypetalae,* because the calyx has its segments in two series; and it cannot be denied that, if paper characters are alone to be consulted, this ought to be the proper course. But if we compare *Cocculales* with the orders with

which they are thus associated, we cannot find one other important circumstance of agreement. It is usual to station them near *Berberaceæ* or *Anonaceæ;* but what their affinity really is with such orders it is difficult to conceive, even if we admit their relationship to *Schizandreæ.* But if we look at them with an unprejudiced eye, we cannot fail to be struck with their general resemblance to *Smilaceæ* among Endogens, differing in little except their Dicotyledonous, more highly developed, embryo, and exogenous stem. In the next place, their floral envelopes, although in two rows, and therefore technically composed of both calyx and corolla, agree altogether with the biseriate calyx of some *Polygonaceæ,* such as *Rumex.* Thirdly, the absence of zones from the wood assimilates them to *Columnosae.* In short, look at these plants in what way we will, their relation seems to be in all important particulars with *Imperfectæ.* I, therefore, station them here at the peril of offending all the prejudices that have been gradually growing up since the appearance of the Genera plantarum of Jussieu in 1789."

The following extract from the same work, (Lindley's Natural System of Botany) explains the changes of position which the seed undergoes, in its progress from the ovule, to the mature fruit.

" According to Aug. de St. Hilaire, the ovule of *Cissampelos* is attached to the middle of the side of a straight ovary, which after fecundation gradually incurves its apex until the style touches the base of the pericarp, when the two surfaces being thus brought into contact unite, and a drupe is formed, the seed of which is curved like a horse-shoe, and the cavity of which is divided by a spurious incomplete dissepiment, consisting of two plates : the attachment of the seed is at the top of the false dissepiment, on each side of which it extends equally. Pl. Usuelles, No. 35. The whole order requires careful revision by means of living plants, and is well worth the especial attention of some Indian botanist."

Geographical Distribution. As already stated, this is mainly a tropical order, the species of which are, with a few exceptions, natives of America, and Asia. Only five are known from Africa, and Siberia has one. Mr. Royle mentions some species as extending up to the foot of the Himalayas, and states that, *Cocculus laurifolius* is only found at elevations, on these mountains, of from 3,000 to 5,000 feet. Of the number of species referable to this order, it seems at present impossible to do more than make a guess, owing to the uncertainty which prevails in regard to them : many having been described under two or three different names, or *vice versâ,* two or three under one. Dr. Lindley estimates them under 100, Roxburgh describes 19, Blume gives characters of 16 from Java, exclusive of allied genera. Dr. Arnott and myself, after reducing some species enumerated in Botanical works, assigned 11 as the number referable to the Peninsular flora : one or two I have since added, but even with these additions, I doubt whether the continental flora, so far as yet known, contains more than 25 species. Dr. Wallich, in his list of Indian plants, enumerates 31, but not all continental, and as some of them have, on more careful examination than he had time to bestow, been found untenable, I believe, my estimate though moderate, will be found rather to exceed than fall short of the actual number, on excluding Stauntonia, which Mr. R. Brown does not consider a member of this order.

Properties and Uses. This order though of limited extent, and having nothing attractive in its appearance, yet claims for itself, much consideration, on account of the valuable properties many of its species is known to contain. To it we are indebted for the deservedly esteemed Colombo root, the produce of *Cocculus palmatus,* so valuable on account of its tonic, and antiseptic properties : the *Pareira brava,* which was at one time esteemed so powerful a lithontriptic, that it was expected to render useless the operation of Lithotomy, and is still considered in Bazil, its native country, as a most useful remedy in all affections of the urinary passages. To this order also, we are indebted for the *Cocculus indicus,* so well known in commerce, but for purposes of such doubtful propriety, that its employment by the brewer to adulterate Ale or Beer, is prohibited under no less a penalty than £200 and £500, upon the seller. The *Gulancha,* of this country, so strongly recommended as a febrifuge, (see Calcutta Medical Transactions,) is equally derived from this family. Bitter and tonic properties, in short, seem to pervade every member of the order. The *Cocculus* (menispermum) *palmatus* was formerly successfully cultivated in Madras, but being confined to a male plant, was soon lost, it is how-

ever, I believe, now growing in the Calcutta botanic garden, and is largely cultivated for its root in the Mauritius.

The extract of *Guluncha* may be procured from the bruised stems of both *Cocculus verrucosus* and *cordifolius,* two very nearly allied species, the former, the produce of the Eastern Islands, the latter, met with in every part of India. The young shoots of the latter are prescribed as a tonic and alterative by the native doctors, and Dr. Ainslie informs us, apparently from his own knowledge of the fact, that the root, in doses of from 15 to 20 grains is a powerful emetic; in which case, it would probably form an excellent substitute for Ipecacuanha. Those who propose making trials of the medicine, ought to collect the plant during the dry season, as it is found to become quite inert during the wet. Several other species of *Cocculus* are common on this coast, and probably all possess to a greater or less extent, similar properties. *Anamirta (Menispermum) Cocculus,* is abundant in Malabar, and also in the jungles of Courtallum. The seed of this plant is now ascertained to be an active irritating poison to quadrupeds and fishes, and is supposed to be so to man, as it communicates a poisonous quality to the flesh of fishes poisoned by it. They are not I believe used internally in medicine, but powdered and mixed with oil, they are used in Malabar in the cure of the inveterate cutaneous diseases, so common on that coast. These seeds have been repeatedly analysed: the kernel is oily with a nauseous and intensely bitter taste. On analysis it produced nearly half its weight of fixed oil, a concrete of the consistence of wax, an albumenous " Vegeto-animal" substance, a colouring matter, and a bitter crystalizable principle, to which the name of *Picrotoxia* (bitter poison) has been given, on which its poisonous properties depend, and which is so active, that 12 grains given to a dog killed it in about 50 minutes, notwithstanding the copious vomiting which it excited. What renders this a more redoubtable agent is, the circumstance of its leaving scarcely any trace of its presence on the coats of the stomach. It seems a subject worthy of the attention of Chemists, to ascertain whether a similar principle exists in the seed of other species. Ceylon produces a large twining shrub, which Gærtner and Roxburgh have described under the name of *Menispermum fenestratum,* but which Mr. Colebrooke has with great propriety removed from that genus and constituted it the type of a new one under the name of *Cosinium,* the wood of which is yellow and bitter, and when sliced and infused in water for a few hours, is swallowed with the infusion, and recommended as an excellent stomachic.

The allied genera of *Cissampelos* and *Clypea* possess bitter and tonic properties analagous to the these found in *Cocculus,* and are used as such by native practitioners. The roots however of *Cissampelos glabra* Roxb. are stated by Roxburgh to be extremely acrid, but are notwithstanding used in medicine by the native practitioners. In the West Indies and America, where the true *Ciss. Pareira* is found, it is much employed as a tonic in diseases of debility, as well as in those affecting the urinary organs, and is there esteemed, and even called, a universal medicine. Sir B. Brodies in his lectures on diseases of the urinary organs recommends it as particularly valuable, in all cases where there is a copious discharge of urine with a ropy alcaline mucus. It is also serviceable in catarrhus vesicæ.

Remarks on Genera and Species. The number of genera referable to this order is large in proportion to the number of species; four only of these have however, as yet, been found in the Indian Peninsula, viz. *Anamirta—Cocculus—Cissampelos* and *Clypea,* all readily distinguished by their male flowers. *Anamirta,* by having its stamens numerous and united into a globose head. *Cocculus,* by having them all free, and limited to sex, each embraced by a petal, or petaloid scale. *Cissampelos,* by having four stamens united into a quadrangular disk, a 4-sepaled calyx, and petaloid scales combined into a single, cup-like, petal, embracing the single filament. *Clypea,* by having the stamens united, and forming a circular disk, surrounded by a 6-lobed calyx, and united, petaloid scales, as in *Cissampelos.* The seed in all are oblique, and curved, so as to bring the ends together like a horse-shoe. With reference to the species, I have nothing to offer in addition to what has been already said in our flora, with the exception, that Rheede's figure vol. 7, tab. 62, quoted for *Cocculus suberorsus,* or *Anamirta Cocculus,* is more properly referable to *C. macrocarpus,* and that vol. 7, tables 19, 20 and 21, quoted for *C. malabaricus,* and *C. cordifolius,* seem all referable to the same species, and I think have a strong general resemblance to *Anamirta,* but certainly want the panicled inflorescence of that genus. Neither of these however, are good figures of *C. cordifolius.* Our genus *Clypea,* embraces the elements of two

genera, the first species, *C. harnandifolia*, being a true species of *Clypea*, while *C. Burmanni*, may form the type of an intermediate genus, but more nearly approaching *Cissampelos*, than *Clypea :* and for which Dr. Arnott proposes the name of *Cyclea ;* distinguishing it from both, by the male calyx being of one piece, campanulate, 4-lobed ; and collaterally by the absence of the foliacious bracts at the base of the female pedicels. To each of these genera, an additional species has recently been added. That to *Clypea*, which Dr. A. has designated *C. Wightii*, a species I found at Courtallum, is at once distinguished from *C. harnandifolia*, by the male flowers being all collected into a single capitulum, in place of forming an umbel of 5 or 6 long peduncled capitula. I hope soon to publish outline figures, of these species, as well as of all those, ascertained to be endowed with useful properties.

EXPLANATION OF PLATE 7.

1. Flowering shoot of *Cocculus macrocarpus*, male plants.
2. Panicle of ripe fruit, *natural size.*
3. Male flowers, showing the sepals, and anthers, one with the sepals, slightly 3-lobed at the apex, the other a smaller flowered variety, with the sepals entire.
4. A detached stamen, with its adjoining petal.
5. A dried mature carpel, as seen in the herbarium.
6. The same, one-half of the testa removed to show the seed.
7. The seed *in situ*, cut longitudinally, to show the form of the cotyledons.
8. The same removed from the testa, the pointed or superior extremely, the radical—*all more or less magnified.*

Observation.—The cotyledons are enclosed in a thin coating of albumen, not shown in the plate.

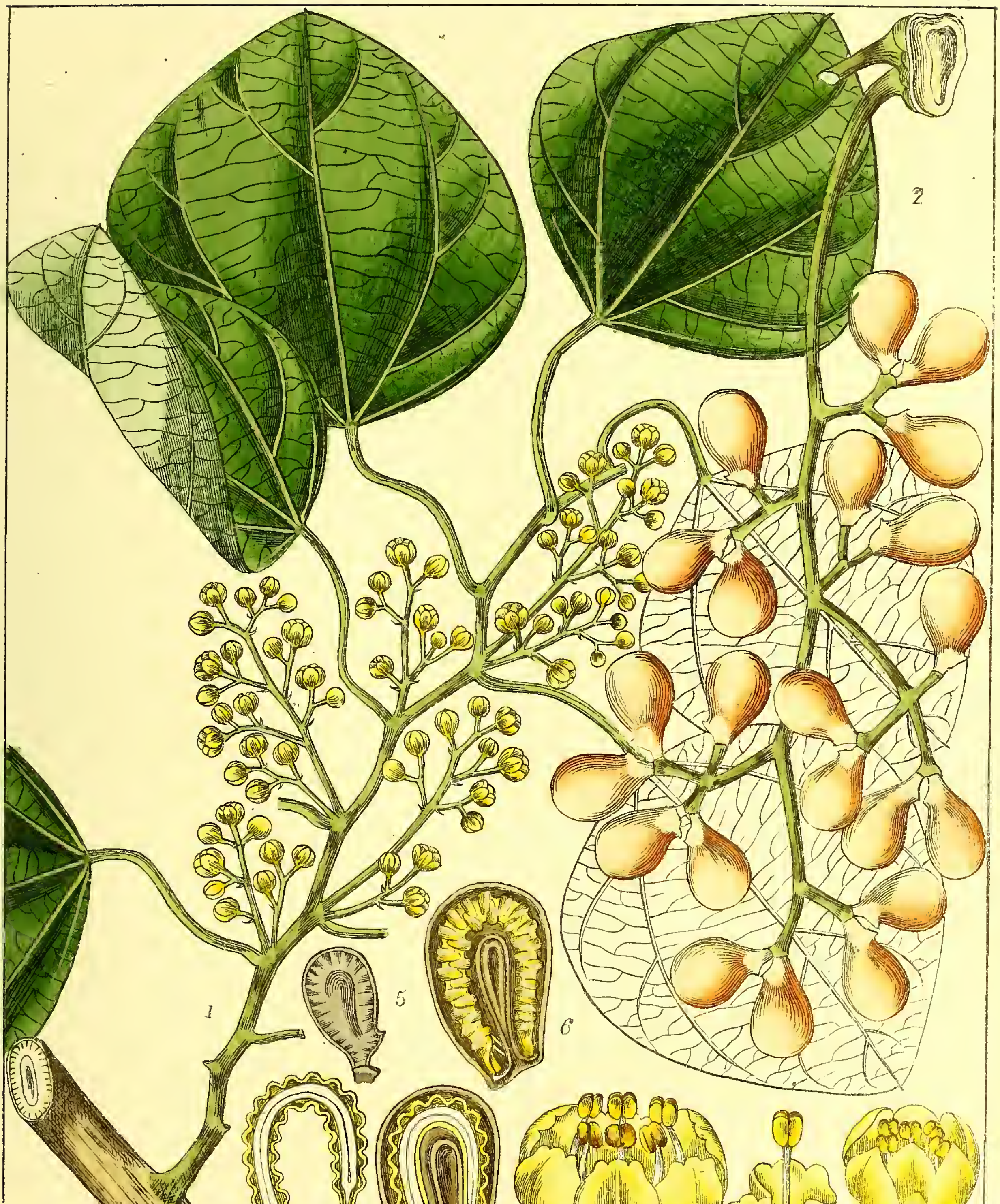
VI.—BERBERIDEÆ.

A small extra-tropical order, consisting for the most part, of small trees and shrubs, rarely herbs, with scattered, petioled, simple or pinnate, leaves ; the margines furnished with spinous teeth. The flowers are regular, hermaphrodite, racemose or solitary ; yellow, white, or reddish, being the prevailing colours.

The calyx is inferior, free, of 3—4—6—early diciduous sepals, which are often coloured or petaloid and surrounded by several bractioles, are ranged in a double series, with the margines overlapping each other, previous to the opening of the flower, (per Œstivationem alternatim imbricatis). Petals, equalling the number of sepals, and placed *opposite !* to them ; within, often furnished with scales or glands at the base. The stamens are free, equal to the number of petals, and are placed opposite them ; the filaments short, occasionally so irritable, that on being slightly touched on the inner surface near the base, they spring forward with elastic force, and strike the anther against the stigma. Anthers two-celled, the cells bursting with elasticity by recurved valves* from the base to the apex, and not according to the more usual form, by pores or a longitudinal slit. Ovary superior, one-celled, with several ovules, usually springing from the base, erect : style short : stigma thick, orbiculate. Fruit a fleshy berry, or indihescent, capsule, with few, exarillate, erect, albumenous, seed ; albumen fleshy, or horny, with the straight embryo in the axis.

Affinities. The affinities of this order, like those of *Menispermaceae* seem as yet doubtful, and uncertain, much diversity of opinion prevailing, regarding them, among Botanists. Generally they are considered very closely allied to *Menispermaceae*, on account of their ternary arrangement of the parts of the flower, and the stamens being opposite the petals. In both orders there is a double verticel of sepals, and in both, the petals are opposite the stamens : but the habit, unisexual flowers, and structure of the ovary of the latter, is different, Dr. Lindley thinks them more nearly allied to the grossulareæ, (the currant and gooseberry tribe) a view in which he is well supported by the similarity of habit of the two orders ; as however the question is one of little consequence to Indian Botanists, where but one genus of

* In preparing the figure, this curious piece of structure was overlooked by the draughtsman, owing to his magnified figure of the anther, being made from a young stamen taken from an unexpanded flower bud, in place of a full grown flower.



Rungia del. R.W. Lith.

COCCULUS MACROCARPUS.

the order, *Berberis*, exists it would be a fruitless labour to pursue the inquiry. In the singular structure of the anthers, there is a striking analogy with *Laurinæ* and other orders, not otherwise akin to *Berberideæ*.

Essential Character. Polypetalous, dicotyledons with fewer than 20 stamens, *anthers with recurved valves* ; ovary wholly superior : carpels solitary : leaves furnished with stipules.

Geographical Distribution. Of this order I doubt whether there is one species that truly deserves to be considered tropical. In so far as India is concerned, I believe, this is strictly correct ; all the species yet found in this country, being from high hills, where the reduced temperature amply compensates for low latitude. De Candolle (Syst. Veg.) gives a brief summary of their distribution over the globe in nearly the following words " Natives of mountainous places in the temperate parts of the northern hemisphere, and of South America as far as the straights of Majellan, none in Africa, Australia, nor in the South Sea Islands." In India I have found them on the Neilgherries, Pulney mountains, and on the more elevated regions of Ceylon ; but none under 5,000 feet of elevation above the sea. Mr. Royle has several species from the Himalayas.

Properties and Uses.—Under this head I have but a few words to offer. The plants composing the genus *Berberis*, are in their native places, very ornamental, but I greatly fear, will not prove such on the plains of India, could we even succeed in introducing them. The berries are acid and astringent, very agreeable to the taste, and in Europe, are employed to make cooling and refreshing drinks for patients affected with bowel complaints accompanied with heat of skin, thirst, and other febrile symptoms : in Nepal those of *Berberis cristata*, are dried by the hill people and sent down as raisins to the plains. The wood and bark are strongly astringent, and are employed medicinally on account of these properties, either in tincture, or infusion. In the Upper provinces of India, we learn from Mr. Royle, that an extract, prepared by digesting in water sliced pieces of the root, stem and branches, of any of the species of Barberry, in an iron vessel, boiling for some time, straining, and then evaporating to a proper consistence ; is much employed in Indian medicine, and every where known under the name of *Rusot*. This extract, he considers the Lyceum of Dioscorides. He adds " The *rusot* is much used by native practitioners, as an external application, both in the incipient and advanced stage of Ophthalmia ; it is frequently also employed by European practitioners, either alone, or with equal parts of Opium and alum rubbed up in water, and applied round the eye. I have seen it particularly useful when the acute symptoms have subsided and the eye is so much swollen as to prevent the effectual aplication of any other remedy. By one surgeon of rank and experience, it was found particularly useful in the ophthalmia with which the European soldiers were afflicted on their return from Egypt ; and Mr. Playfair, the translator of the Taleef-Shureef, says, it is perhaps the best application in Ophthalmia, ever used."

So far as I have been able to learn this medicine is quite unknown in Southern India, I would therefore suggest, on the strength of the above very respectable authorities, that some of this extract should be prepared from the species found on the Neilgherries, which are the same as those found on the Himalayas, and subjected to experiment.

In a commercial point of view the species represented is not undeserving of notice, one of the first European chemists (Vauquelin) having ascertained it to be inferior to few woods for dying a yellow colour, a fact, the value of which is enhanced, not less by the facilities of exportation to the coast, by the recently formed roads, than by the extent to which it may be supplied ; the species having a wide range of location along the western range of mountains. Mr. Drury in his report on the commercial products of the Coimbatore district mentions this shrub, adding " that, from experiments which have been made, the root of the tree yields the finest dye." He submits some samples of cloth dyed from the wood, the colours of which I have attempted to imitate on the three squares in the accompanying plate, whether these will be found permanent, technically " fast colours" remains to be ascertained, much of that property depending on the mordants used for fixing them.

Remarks on Genera and Species. As only one genus of *Berberideæ* has yet been met

with in India, it affords no room for remark, I may however observe, that, I think there is a new species of Berberis on the Pulney mountains, referable to the section *Mahonea*, with pinnated leaves. I speak doubtfully, because I did not find flowers or fruit, and judge from habit alone: the Pulney plant being a diffuse shrub, with long, somewhat scandent branches, and the Neilgherry one an erect, sparingly branched tree. In all other respects, so far as I was enabled to judge, they are much alike, with this exception, that the Pulney one is met with at an elevation of about 5,000 feet, the Neilgherry one, to the best of my recollection, not under 7,000 feet of elevation.

EXPLANATION OF PLATE 8.

1, 2. Branches of the Berberis tinctoria, one in flower, the other in fruit, but not yet mature—*natural size.*

3. Bracts, sepals and ovary.

4. Petals and stamens, petals, each with two glands at the base.

5. A detached petal.

6. Back and front views of the stamens.

7. Ovary cut vertically, showing the erect ovules, supported on a short pedicel.

8. A mature fruit.

9. The same cut vertically, to show the seeds—*all more or less magnified.*

The square figures in the corner represent three samples of cloth, dyed of similar colours, from the wood of this shrub.

Observation.—The detached stamen was taken from a young, dried, flower bud, and did not present the characteristic valvular dehiscence of the order; a defect, unfortunately, overlooked, until the impression had been printed off.

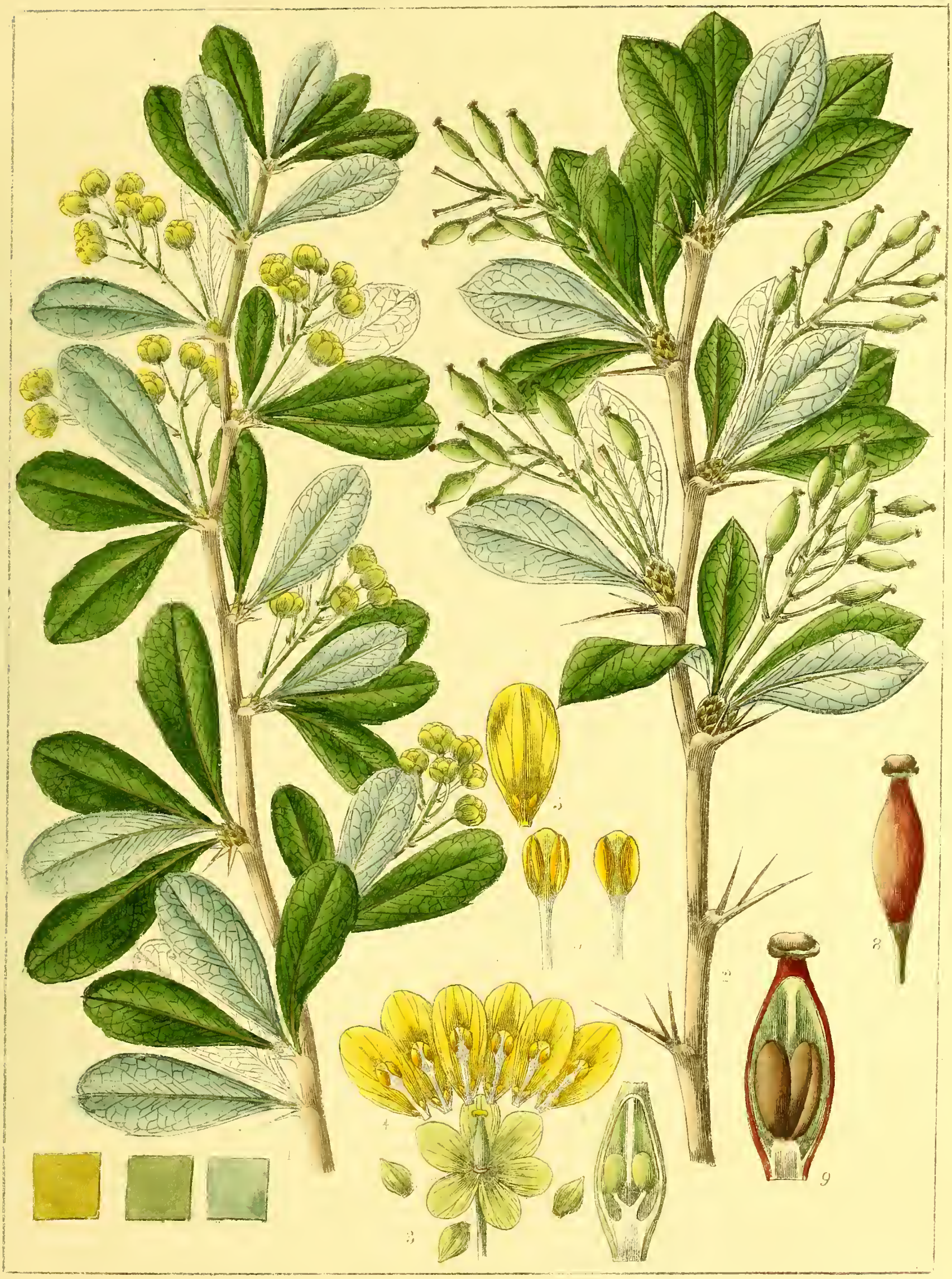
VII.—NYMPHŒACEÆ.

A small order of aquatic, herbaceous, floating plants; with peltate, or cordate, fleshy leaves; widely distributed over the northern, but very rare in the southern hemisphere; more remarkable for the beauty of their flowers, and peculiarities of structure of their seed, which has given rise to much discussion among Botanists as to their affinities and station in the system of vegetables, than for their useful properties.

The flowers are distinguished, by their numerous imbricated sepals, and petals, passing gradually into each other, but finally distinguished, by the former being persistent, while the latter separate like those of other flowers. The petals, and stamens, are inserted into a large disk which surrounds, and more or less covers, the pistil, and pass imperceptibly into each other. The stamens are numerous, and inserted into the disk above the petals; the filaments are petaloid, the anthers adnate, bursting inwards by a double longitudinal cleft. Ovary superior, polysporous, many celled, with numerous stigmas, radiating from a common centre, forming a sort of cup. The fruit is many celled, indehiscent, with numerous albumenous seeds, attached to its spongy partitions, and enveloped in a gelatinous aril. Albumen farinacious. Embryo small, on the outside of the base of the albumen, enclosed in a membranous bag. Cotyledons foliacious.

Affinities. I have already observed, that much diversity of opinion exists among Botanists as to the affinities of this order, these, have been carefully examined by Dr. Lindley, and are ably stated by him in his Natural System of Botany, from which I shall introduce a rather long extract, explanatory of his views of their structure, the principal question being to determine, whether they are Mono—or Dicotyledons.

" There exists a great diversity of opinion among Botanists as to the real structure of this order, and, consequently, as to its affinities. This has arisen chiefly from the anomalous nature of the embryo, which is not naked, as in most plants, but enclosed in a membranous sac or bag. By some, among whom was the late L. C. Richard, this sac or bag was considered a Cotyledon, analogous to that of grasses, and enveloping the plumule; and hence the order was referred to Endogens, or Monocotyledons, and placed in the vicinity of *Hydrocharaceæ*. By others, at the head of whom are Messrs. Mirbel and DeCandolle, the sac is considered a membrane of a peculiar kind; and what Richard and his followers denominate plumule, is for them a 2-lobed embryo, wherefore they place the order in Exogens, or Dicotyledons. I do not think it worth citing all the arguments that have been adduced on each side the question, as Botanists



Rungia. del. R. W. Lith

BERBERIS TINCTORIA. (Lesch.)

seem now to be generally agreed upon referring *Nymphœaceœ* to Dicotyledons. I observe moreover, that Von Marties, who once adhered to the opinion, that *Nymphœaceœ* are Monocotyledonous, and nearly related to *Hydrocharaceœ*, (see Hortus Regius Monacensis, p. 25) now places the order in its true position near *Ranunculaceœ* (see Conspectus, No. 188). Those who are curious to investigate the subject are referred to DeCandolle's Memoir, in the first volume of the Transactions of the Physical and Natural History, Society of Geneva. In this place it will be sufficient to advert briefly to the proof, that is supposed to exist of *Nymphœaceœ*, being Dicotyledons. In the first place, the structure of the stem is essentially that of Exogens, according to Mirbel's examination of the anatomy of *Nuphar luteum*, in the Annales du Museum, vol. 16, p. 20; and of *Nelumbium*, the close affinity of which, with *Nymphœaceœ*, no one can possibly doubt, in the same work, vol. 13, t. 34. In both these plants the bundles of fibres are described as being placed in concentric circles, the youngest of which are outermost; but they all lie among a great quantity of cellular tissue: between each of these circles is interposed a number of air-cells, just as is found in *Myriophyllum* and *Hippuris*, both undoubted Dicotyledons in the opinion of every body, except Link, who refers the latter to Endogens, (see Gewachsk, 6, p. 288). Secondly, the leaves are those of Dicotyledons, and so is their convolute vernation, which is not known in Monocotyledons, and their insertion and distinct articulation with the stem. Thirdly, the flowers of *Nymphœaceœ* have so great an analogy generally with Dicotyledons, and particularly with those of *Magnoliaceœ*, and their fruit with *Papaveraceœ*, that it is difficult to doubt their belonging to the same group. Fourthly, the reasons which have been offered for considering the embryo Monocotyledonous, however plausible they may have appeared, while we were unacquainted with the true structure of the ovule of other plants, have no longer the importance that they were formerly supposed to possess. The sac, to which I have already alluded, to which so much unnecessary value has been attached, and which was mistaken for a cotydelon by Richard, is no doubt analogous to the sac of Saururus and Piper, and is nothing more than the remains of the innermost of the membranous coats of the ovule, usually indeed absorbed, but in this and similar cases remaining and covering over the embryo. Brown (appendix to King's voyage) considers it the remains of the membrane of the *Amnios*. DeCandolle assigns a further reason for considering *Nymphœaceœ* Dicotyledons, that they are lactescent, a property not known in Monocotyledons. But in this he is mistaken; *Limnocharis*, a genus belonging to *Butomaceœ*, is lactescent. It must moreover be observed, that the arrangement of the woody matter of *Nuphar luteum*, is far less obviously exogenous than would be supposed from the manner in which it is described by Mirbel." See Lindley's Natural System of Botany, 2d Ed. page 11.

This order in addition to the peculiarities above cited, affords one of the best examples of the gradual transition of sepals into petals, and petals into stamens, there being intermediate rows of both, that belong neither to the one set, nor the other. In some as *Nymphœa*, the disk is so remarkably developed, that it elevates itself as high as the top of the ovary, to the surface of which it adheres, and the stamens being carried up along with it, appear to proceed from the top of the ovary; and "in the genus *Barclaya*, the petals also are carried up with the stamens, on the outside of which, they even co-here into a tube, so that in this genus we have the singular instance, of an inferior calyx, and superior corolla, in the same plant." Lindley.

As the affinities of this order have been so repeatedly and carefully examined by the ablest Botanists of the age; I shall in preference to attempting to state them in my own words; again have recourse to Dr. Lindley's assistance, and introduce another extract from his excellent work.

" Supposing this order to be exogenous, and Dicotyledonous, a fact about which, there appears to me to be no doubt, its immediate affinity will be with *Papaveraceœ*, with some genera of which it agrees in the very compound nature of the fruit, from the apex of which the sessile stigmas radiate, in the presence of narcotic principles and a milky secretion, and in the great breadth of the placentæ. *Nymphœaceœ* are also akin to *Magnoliaceœ*, with which they agree in the imbricated nature of the petals, sepals, and stamens; to *Nelumbiaceœ*, their close resemblance is evident; with *Ranunculaceae*, they are connected through the tribe of *Paeonies*, with which they agree in the dilated state of the disk, which, in *Paeonia papaveracea* and *Moutan*, frequently rises as high as the top of the ovaries, and in the indefinite number of their hypogynous stamens; but in *Ranunculaceae*, the placentæ only occupy the

edge of each of the carpels, of which the fruit is made up; so that in *Nigella,* in which the carpels co-here in the centre, the seeds are attached to the axis, while in *Nymphœaceae,* the placentæ occupy the whole surface of each side of the individual carpels, of which the fruit is composed. But if such are the undoubted immediate affinities of *Nymphœaceae,* it is certain that some strong analogies exist between them and *Hydrocharaceae,* to the vicinity of which they are referred by those who believe them to be Monocotyledonous. Taking *Nelumbiaceae* for a transition order, they have some relation to *Alismaceae,* the only Monocotyledonous order, in which there is an indefinite number of carpels in each flower, and to *Hydrocharaceae,* with which they agree in the structure, though not the vernation, of their leaves, and their habit. An analogy of a similar nature with this last may be also traced between them, and the monopetalous sub-order, *Menyantheae.*"

Geographical Distribution. It is commonly remarked respecting aquatic plants generally, that the same species are found in the most distant regions. The *Nymphoeaceae* form an exception to this law, each species being confined to a comparatively limited range of territory. Four, according to De Candolle, (System Veget.) are natives of Europe; 2 of Egypt; 2 of Siberia; 9 of the warmer parts of Asia and Japan: 9 of North America; and 1 of the Cape, with the exception of which, they are almost unknown in the southern hemisphere. Mr. Royle well remarks, that India may be considered their head quarters, as species of all the genera, except *Nuphar,* (the English yellow water lily) are found in it; namely, *Nymphœa, Euryale,* and *Barclaya,* and of *Nymphœa* a greater number than in any other country. Of this last genus the same species, with the exception of the red varieties of *N. rubra,* are found in every part of India, from the extreme south to the most northern confines.

Properties and Uses. These beautiful aquatics have justly been the admiration of mankind in all countries where they grow, from the earliest ages; while their habitation in the midst of cool and placid waters, combined with the chaste whiteness of their flowers, have tended to clothe them, in their estimation, with imaginary properties: for from what other source could have sprung the belief, that plants, whose sensible properties are essentially tonic, should be endowed with sedative, cooling, and anti-aphrodisiac powers of such intensity, as to cause total indifference to sexual intercourse, or even absolute sterility. That such an opinion is purely imaginary, may I think be safely inferred, from the estimation in which both the roots and seeds of nearly all the species, natives of this and the adjoining countries, are held, as affording a wholesome and nourishing food. In this country the capsules and seed together are prepared in various ways, sometimes pickled, sometimes stewed or made into curry, and sometimes, the seed are ground and mixed with meal to make cakes. The underground stems, or roots, as they are commonly called, are composed in great part of fecula, better known, perhaps, under the names of Starch, and Arrow root, and are used both as aliment and medicine. In Africa we learn from the Flora Senegambiæ that the fruit is equally sought after by the inhabitants, and by the wild animals of the jungles. The Authors remark, 'it is surprising to see, at the season of their maturity, the numbers of women and children returning towards evening, to the village, laden with these fruits, which they lay in the sun until they dry and open naturally.' The seed are prepared for use by simply boiling, and then quickly torrifying them, by which they acquire a very agreeable taste. The farinacious roots are equally used for food, being first roasted among the cinders, when they acquire a taste resembling potatoes.

Dr. Ainslie, in his Materia Indica (Vol. 2, page 234) suggests, in opposition to the opinion of the late Dr. Rottler, that the *Nedel Kalung,* meaning, nedel root, is not a species of *Nymphœa,* but of *Menyanthes, M. indica,* a conjecture, to which he is led "by the name of the last mentioned plant being according to Rheede, *Nedel-ambel.*" I have endeavoured to ascertain how far this conjecture is correct, and find reason to believe that he is partly right, as *nedel* is a name by which the *Menyanthes* is known here: *ambel,* on the other hand, is applied to a very different plant, namely, the *Damasonium indicum,* equally an aquatic, but differing in every other respect, and having no one point of affinity beyond growing in water: a striking instance of the little faith to be reposed in native names, since Dr. Rottler's proverbial accuracy, and extensive knowledge of Indian plants, scarcely leaves room to doubt, that the plant shown to him as the *Nedel* was truly a *Nymphœa.*

Rungia del

NELUMBIUM SPECIOSUM. (*Willd.*)

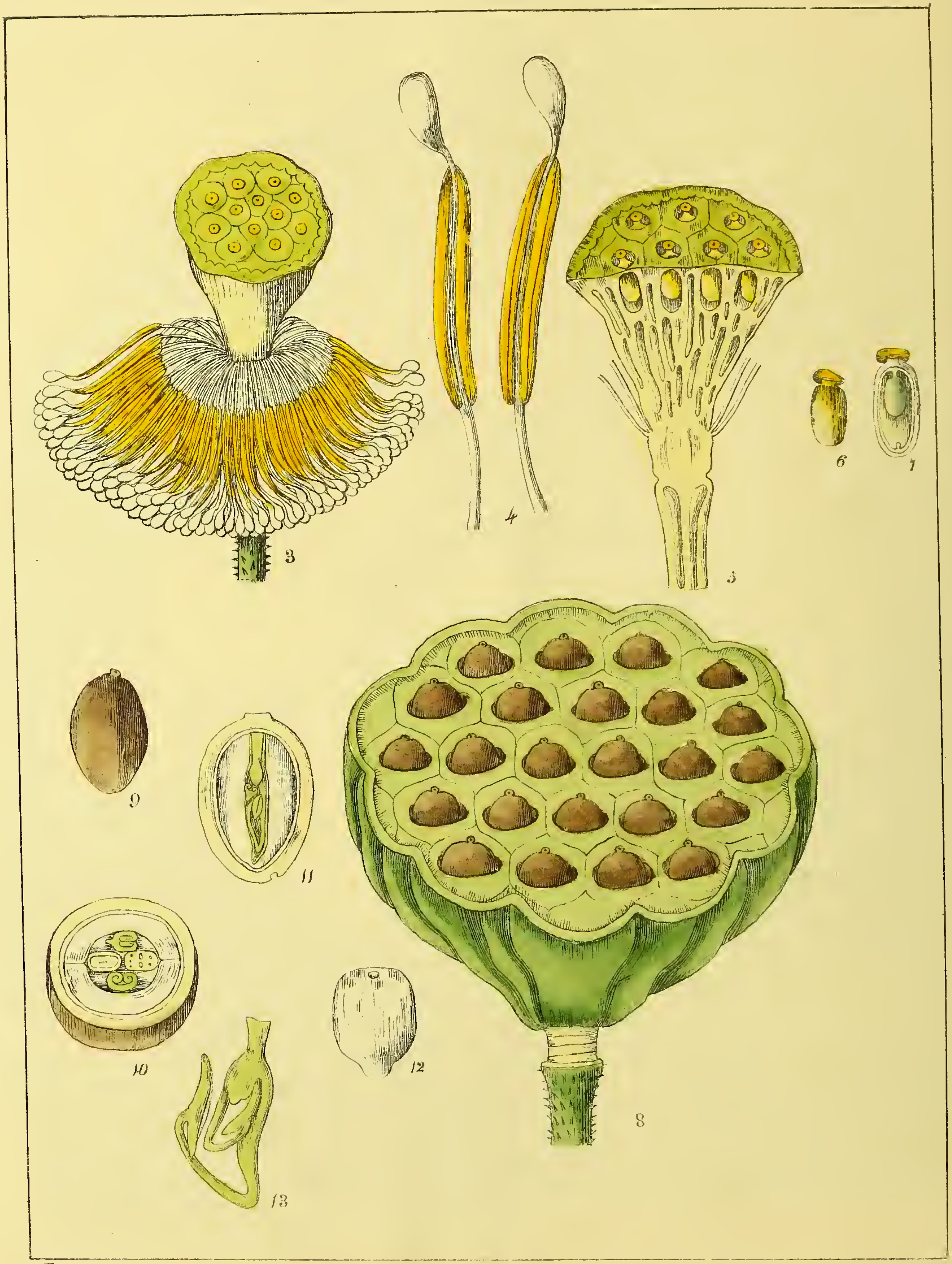
தாமரை கொடி

Thamaray Codie

దామరతీగె, పంకేరుహం

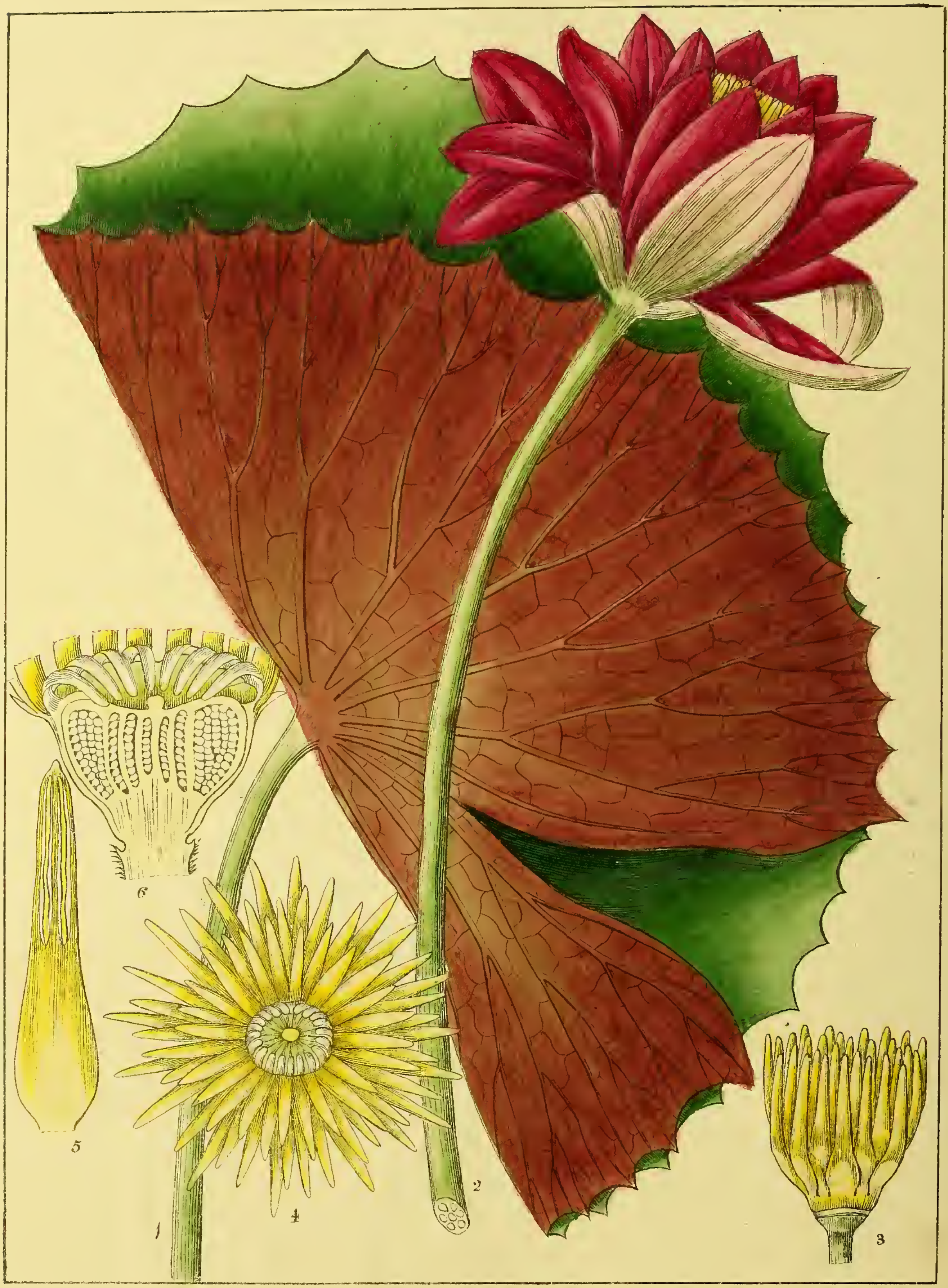
Damara Thega.

Punku Roogum.



Rungia del.

NELUMBIUM SPECIOSUM *(Willd)*



Rungia del

NYMPHÆA RUBRA.

அலலிககொடி

Allu Codie

కలువతీగ

Kulluva thega

EXPLANATION OF PLATE 10.

1, 2. Leaf and flower of Nymphœa rubra---*natural size.*

3. Side view of the stamens.

4. Front view, the stamens laid back to show the stigmas. 5. Stamen detached. 6. Ovary cut vertically, showing the numerous cells, and the ovules, attached to the broad placentary surface, covering the whole surface of the partitions.

Observations.---This plate, though correct so far as it goes, does not carry the analysis of the order quite far enough, a dissection of the seed is required to complete it. This defect arose from its being overlooked at the time of making the drawing, several years ago, and my inability to get sufficiently ripe fruit, when preparing the figure for the press.

VIII.—NELUMBIACEÆ.

This order is so closely allied in most respects to the former, that a very brief notice, after the very detailed one given of *Nymphœaceœ* will suffice to explain its peculiarities which solely appertain to the fruit. In place of the many-celled and many-seeded cells placed in a circle round the central axis of *Nymphœaceœ*, these, have an excessively enlarged fleshy disk, enclosing in hollows of its substance, the ovaries, which are numerous, separate, monspermous, with a simple style and stigma : the mature nuts are half buried in its substance, from which they finally become loose and separate. They further differ in having exalbuminous seed. The embryo is large, with two fleshy cotyledons, and a highly developed plumule enclosed in its proper membrane. In habit they agree with *Nymphœaceœ.*

In their Affinities, Geographical Distribution, and Properties, these two orders are so intimately united, that to go over these with reference to *Nelumbiaceae*, would be merely to repeat much that has been already said respecting *Nymphœaceœ*, suffice it therefore to say, that they are distributed widely over the northern hemisphere, *Nelumbium speciosum* occupying the still waters of the old, while *N. luteum* occupies those of the new world. In this country and China, both the creeping root-like stems and nuts, are used as food.

The leaf and flower stalks of this plant abound in spiral tubes more loosely combined, and perhaps stronger, than the same vessels in most other vascular plants. These in the southern provinces are extracted with great care by gently breaking the stems, and slowly drawing apart the ends. Long pieces of the spiral filament, composing the tube, are thus uncoiled. With these filaments " are prepared those wicks which on great and solemn religious occasions are burnt in the lamps of the Hindoos placed before the shrines of their gods."—Ainslie. Similar wicks are prepared from the spiral tubes of some of the Nymphœas but are not thought so sacred.

In sowing the seed of this plant it is customary to enclose them in a ball of clay before throwing them into the water.

EXPLANATION OF PLATE 9.

1, 2. Nelumbium speciosum, (white variety) flower, and part, (little more than one-fourth) of a leaf—*natural size.*

3. Stamens, and greatly enlarged, fleshy disk, with the ovaries in situ—*natural size.*

4. Stamens magnified, back and front view.

5. Disk cut vertically, showing the hollows in its substance, and enclosed ovaries---*somewhat magnified.*

6. Ovary removed. 7. The same cut vertically, showing the pendulous ovule---*both magnified.*

8. A mature fruit, the carpels half enclosed, and becoming loose---*natural size.*

9. A nut. 10, 11. The same cut transversely and vertically.

12. Embryo enclosed in its proper sac.

13. The same removed from the sac, and somewhat unfolded---*all more or less magnified.*

IX.—PAPAVERACEÆ.

A small, but very important order of herbaceous, or suffruticose, milky plants ; with alternate leaves, and long one-flowered peduncles, but so strictly extra-tropical, that, but for the perfect naturalization among us of *Argemone Mexicana,* an American member of the order, I should not have been able to have given a representation of the family, taken from a growing specimen.

The calyx in this order consists of only two sepals, and these so caducous, that for the most part, they drop nearly as soon as expanded. The carolla is composed of 4 petals, or of twice or three times that number, but always of some multiple of four; the stamens in like manner, though generally numerous, are always some multiple of four, rarely only eight, forming four bundles, one inserted at the base of each petal; the anthers are two-celled, erect, opening within. Ovary solitary, stigmas sessile, or with a short style, two, or many, and in the latter case, stellate on the flat apex of the ovarium. Fruit one-celled, with parietal placentæ, equalling the number of the stigmas : albumen between fleshy and oily, at the base of which, is a minute straight embryo, with plano convex cotyledons.

Affinities. The nearest affinity of this order is with *Ranunculaceæ*, from which, in some extreme cases, it is scarcely to be distinguished except by the difference of the juices, which in this is milky, yellow, or white, and narcotic, in that aqueous and acrid.

Essential Character. Polypetalous, polyandrous, anthers inate : ovary wholly superior : carpels combined into a solid fruit, with more placentas than one. Juice milky, leaves alternate exstipulate.

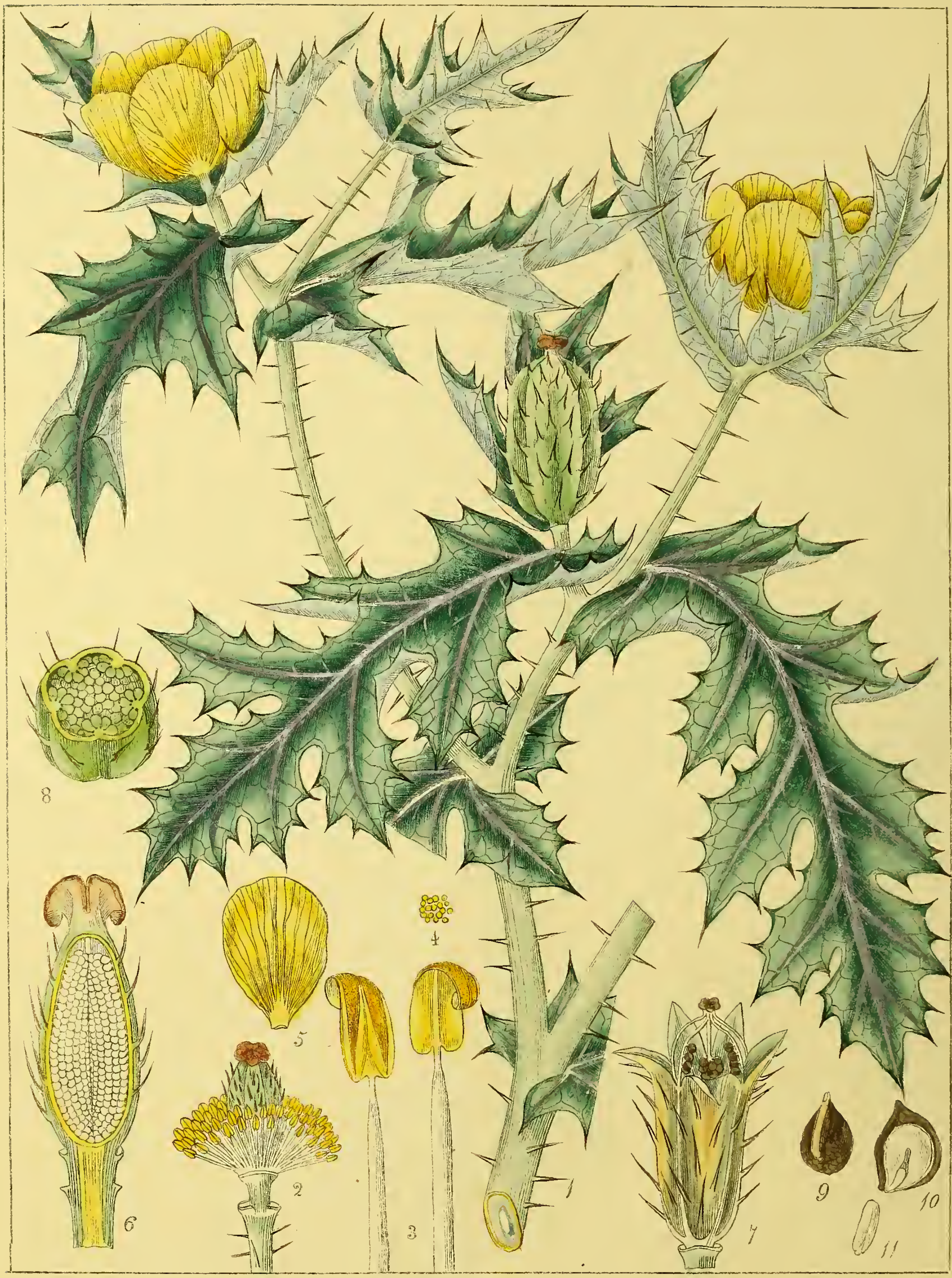
Geographical Distribution. This, as already remarked is so completely an extra-tropical order that, with the exception of *Argemone Mexicana* a naturalized plant, not one is found on the plains of India. Europe is their principal seat, being there found in all directions, and containing nearly two-thirds of the whole order.

Properties and Uses. The narcotic is the predominating principle of this order. The seeds however of *Argemone Mexicana* are said to possess emetic properties, and are used in South America and the West Indies as substitutes for Ipecacuana. Other accounts however state that they are powerfully narcotic, especially when smoked with tobacco. Whether these opposite statements are founded on carefully ascertained facts, and can be reconciled, remains to be proved. The juice of this plant is employed in this country as a remedy for cutanious diseases, and is said to be a very effectual one. I confess I have never either prescribed the remedy myself, nor seen it employed by others. The native doctors also employ it as a remedy for ophthalmia; applied, according to my information, over the tarsus and eyelids, but according to Dr. Ainslie's statement, dropped into the eye. The oil, extracted from the seed, is, like the juice, considered a useful application in cutanious diseases, but probably merely acts as an emolient application like any other sweet oil.

The medicinal properties of the juice of the poppy are too well known to require notice here, but a few remarks may be made respecting this substance in a commercial point of view.

The Opium Poppy, though not a native of India, is now so very extensively cultivated in some of her provinces, those namely of Bahar, Benares, and Malwa, that nearly three millions of pounds of Opium are annually raised in these districts, producing a return to the country of above two and a half millions sterling. This kind of cultivation would, I believe, be made to occupy a much wider range of country were the operations of the agriculturist unrestricted. It has already been tried on the Neilgherries, to a small extent it is true, but sufficient to ascertain the fitness of the soil and climate for the production of Opium of a marketable quality. Many parts of Mysore might equally be appropriated to its cultivation, were the extension of the production of this drug either desirable or necessary. Neither the one or the other however is the case; the more so, now, that the China market is shut against its introduction : a prohibition, likely to inflict ruin and destruction on thousands of persons engaged in the growth and traffic of this much coveted drug, of which there is now, a surplus in hand sufficient to supply the wants of the country for years to come.

This is not the place to discuss the question of its effects on the human constitution, but I may observe in passing, that in this as in many other disputed points, the truth seems to lie between the contending parties. Those who view Opium as the most deleterious of intoxicating substances, of course form their opinion from looking to extreme cases only, but which, if compared with the extreme effects arising from the unrestrained indulgence in the use of spirits, show but too clearly, that the one is nearly as bad as the other, though the latter, from being so much more common among us, and its effects better understood, is less



Rungia del. *W. Smith Lith*

ARGEMONE MEXICANA.

{ பிரமனுகாசி
Brumumkash }

{ బ్రహ్మదండు
Brumadundoo }

thought of. Those on the other hand who are disposed to underrate the injury opium inflicts, draw their conclusions from probably a limited number of cases, or from instances where the drug is used in such moderation, as scarcely to affect the system more, than we daily witness from the habitual use of a small quantity of ardent spirits. That both are bad is undoubtedly true, and equally that the less consumed of either one or the other so much the better for the consumer, but, judging from the accounts of travellers, who have visited countries inhabited principally by Musselmen, nearly all of whom, from being restricted by the ordinances of their religion from indulgiug in the use of spirits, use opium, the balance in favour of spirits does not appear by any means so great, as the former would have us believe ; and as the sources of their (spirits) supply are so much more numerous, and the facility of production so much greater, perhaps upon the whole, could the world be entirely deprived of one of the two, it would be a gainer by the abstraction of spirits. Used moderately and with due discrimination, neither are so bad as extreme moralists would have us believe, while both are in particular circumstances necessary to our welfare ; the one, not seldom, being indispensable, where the other would prove exceedingly hurtful. Used to an injurious excess, language does not possess terms strong enough to portray the horrors which both induce, and which the mere looker on can easily perceive, though none but the confirmed inebriate can adequately describe.

Dr. Macnish (Anatomy of Drunkenness), seems to think that the injurious effects of Opium on the human constitution are not always confined to the individual using it, but may extend to the offspring. The following are the facts on which he grounds this opinion. " An inquest was held at Walpole lately on the body of Rebecca Eason, aged 5 years, who had been diseased from her birth, was unable to walk or articulate, and from her size did not appear more than 5 *weeks* old. The mother had for many years been in the habit of taking Opium in large quantities, (nearly a quarter of an ounce a day), and it is supposed had entailed a disease on her child which caused its death ; it was reduced to a mere skeleton, and had been in that state from birth. Verdict—' Died by the Visitation of God ; but from the great quantity of Opium taken, before birth and while suckling it, by the mother, she had greatly injured its health.' It appeared that the mother of the deceased had had five children ; that she began to take Opium after the birth and weaning of her first child, which was and is remarkably healthy ; and that the other children have all lingered and died in the same emaciated state as the child who was the subject of the inquest." The interesting facts brought to light through this inquest, cannot be made too extensively known, but at the same time, it would be unphilosophical to infer from those stated that, all the evil here recorded was attributable to the Opium, since we are not informed, whether or not, the mother was led into the habit to alleviate distress arising from corporeal disease, perhaps of the organs of generation themselves, from which, the offspring may have in part inherited, the disease to which it fell a victim.

The poppy is largely cultivated in many parts of Europe for the sake of its seed, and capsules, without reference to the juice. The seeds abound in a very pure sweet oil, inferior only to that of the olive, for all culinary purposes to which such oils are applied, and are besides esteemed for their alimentary qualities.

EXPLANATION OF PLATE 11.

1. Flowering branch of Argemone mexicana---*natural size.*

2. Stamens and ovary, the sepals and petals removed. 3, 4. Stamens and pollen.

5. Petal detached. 6. Ovary cut vertically, showing the numerous ovules attached to the parietal placentæ, the whole length of the ovary—*magnified.*

7. Ripe fruit, with valves of the capsule open, leaving the filiform placentæ still attached to the stigma—*natural size.*

8. Fruit cut transversely, showing the 5 placentæ with their attached ovules---*all more or less magnified.*

9. A detached seed. 10. The same cut longitudinally, showing the embryo at the base of a large albumen.

11. Embryo separated.

FUMARIACEÆ.

These viewed in their Botanical relations simply, form a curious and interesting order ; but in Indian Botany, one of very minor importance, only one species being found in the southern

provinces, and that a very doubtful native ; as there appears to be no Tamul or Telogoo name for it. I have however thought it right to introduce it here, as forming a link in the chain of affinities, which it is desirable should remain as much unbroken as the Flora will permit. The only species yet known, in this part of India, is found in corn fields on the Neilgherries, where it was probably brought, with corn seed, either from Bengal or Europe.

The *Fumariaceæ* are glabrous, herbacious, tender plants ; with watery juice ; either annual or perennial ; occasionally with tuberous roots, and alternate, generally, much divided, ex-stipulate leaves ; often furnished with tendrils ; and irregular, hermaphrodite, spiked, bractiolate flowers.

The calyx consists of 2 small sepals : the corolla of 4 petals cruciately placed, one or both of the outer ones saccate at the base, the inner ones callous below and coloured at the apex, where they cohere and inclose the anthers and stigma. The stamens are united in two parcels, and placed opposite the outer petals, each parcel composed of a centre perfect, two-celled anther, and 2 one-celled, imperfect or half, anthers ; very rarely all separate. Ovary superior one-celled, ovules horizontal. Style filiform, Stigma with two or more points. Fruit dehiscent or indehiscent, either a one or two-seeded nut, or a succulent, many-seeded, pod. Seeds horizontal shining, cristed. Albumen fleshy. Embryo, nearly straight, out of the axis.

Affinities. Most Botanists consider *Fumariaceæ* as very nearly allied to *Papaveraceæ* on account of their two-leaved deciduous calyx, the structure of the fruit of the dehiscent species, and their fleshy albumen ; but differing in their watery juice, their irregular petals, and their diadelphous stamens, with indifferently one or two-celled anthers. Dr. Lindley however proposes a different and very ingenious exposition of their structure, which I shall quote in his own words, and which will be easily understood on comparing his description with the magnified figures in the plate. After referring to the above exposition of their structure, he proceeds. " I am, however, inclined to suspect that the floral envelopes of *Fumariaceæ* are not rightly described. I am by no means sure that it would not be more consonant to analogy to consider the parts of their flower divided upon a binary plan ; thus understanding the outer series of the supposed petals as calyx, and the inner only as petals ; while the parts now called sepals are perhaps more analogous to bracts ; an idea which their arrangement, and the constant tendency of the outer series to become saccate at the base, which is not uncommon in the calyx of *Cruciaceæ*, but never happens, as far as I know, in their petals, would seem to confirm. Of this, some further evidence may be found in the stamens. Those organs are combined in two parcels, one of which is opposite each of the divisions of the outer series, and consists of one perfect two-celled anther in the middle, and two lateral one-celled ones : now, supposing the lateral one-celled anthers of each parcel to belong to a common stamen, the filament of which is split by the separation of the two parcels, an hypothesis to which I do not think any objection can be entertained, we shall find that the number of stamens of *Fumariaceæ* is 4, one of which is before each of the divisions of the flower ; an arrangement which is precisely what we should expect to find in a normal flower, consisting of 2 sepals and 2 petals, and the reverse of what ought to occur, if the divisions of the flower were really all petals, as has been hitherto believed."

The following extract also from Dr. Lindley's work, exhibiting a beautiful instance of design, observable in all the works of nature when properly studied, is too interesting to be passed over.

" The economy of the sexual organs of *Fumariaceæ* is remarkable. The stamens are in two parcels, the anthers of which are a little higher than the stigma ; the two middle ones of these anthers are turned outwards, and do not appear to be capable of communicating their pollen to the stigma ; the four lateral ones are also naturally turned outwards ; but by a twist of their filament their face is presented to the stigma. They are all held firmly together by the cohesion of the tips of the flower, which, never unclosing, offer no apparent means of the pollen being disturbed, so as to shed upon the stigmatic surface. To remedy this inconvenience, the stigma is furnished with two blunt horns, one of which is inserted between and under the cells of the anthers of each parcel, so that without any alteration of position on the part of either organ, the mere contraction of the valves of the anthers is sufficient to shed the pollen upon that spot, where it is required to perform the office of fecundation."

Rungia del.

B. CORYDALIS. A. FUMARIA PARVIFLORA. C. DIELYTRA.

By the contemplation of such beautiful, though almost imperceptibly minute, arrangements of the Divine Artist, we are more surely led to form a just estimate of His infinite power, wisdom, and foresight, than even by the contemplation of the boundless vault of heaven, illuminated with the light reflected from its thousands of stars; because in the one case, the immeasurable distance and magnitude of the objects viewed, are too great for the limited powers of the human mind properly to comprehend them, and is but too apt to lead man into the error of under-estimating his own importance in the eye of his Creator. The apparent insignificance of the other is calculated to produce the very opposite effect, while it is equally suited to display the Creator's unerring wisdom and power, by teaching him, that the same power, that filled the universe with thousands of worlds, and made and endowed him with a reflecting mind, equally made the humble fumatory, and so nicely adjusted the arrangement of its minute organs, as to prevent the loss of even a grain of pollen, thus certainly ensuring its due fecundation, and with that, the equally certain preservation of the species. If then, so much care is bestowed on the formation and preservation of the most minute objects of the creation, how much more, have we not a right to infer, is appropriated to the preservation of the Being, formed in his own likeness, gifted with reason, and endowed with an immortal soul?

Geographical Distribution. The *Fumariaceæ* are scarcely known within the tropics: their principal range is in the temperate latitudes of the northern hemisphere, several are found on the Himalayas, and among them some of the handsomest of the order. Two are found at the Cape of Good Hope.

Properties and Uses. Some of these plants are prized in more genial climes, as ornaments of the garden, but are generally too tender for this country. Bitter and tonic properties are those which predominate in the order. Dr. Ainslie informs us that the Hukims consider the species here figured, which he calls *F. officinalis*, diuretic, and useful in maniacal cases. A decoction of the recent plant is used in Europe in scorbutic affections, and chronic eruptions, and is considered in some countries very efficacious, in restoring the tone of the stomach during convalescence from fever.

EXPLANATION OF PLATE 11.*

A. 1. Plant of Fumaria parviflora. 2. Detached flower—*natural size.*

3. The same much magnified. 4. The same opened, showing the petals, stamens ovary, style, and stigma. 5. Stamens detached. 6. Ovary, style, and stigma, detached. 7. The ovary cut vertically, showing the ovule, with its lateral attachment—*all much magnified.*

8. Young fruit—*natural size.*

9. The same—*magnified.*

B. Flower of a species Corydalis, similarly analyzed —1. Flower *natural size.* 2. The same magnified. 3. Opened to show the different parts. 4. Stamens. 5. Pollen. 6. Ovary, style, and stigma. 7. Ovary cut longitudinally.

C. 1. Flower of a species of Dielytra—*natural size.* 2. Magnified. 3. Partially opened. 4. Stamens and ovary detached from the corolla. 5. The same, one half the stamens removed. 6. Ovary cut transversely. 7. A portion of the ovary opened longitudinally, showing the situation of the ovules.

Observations.—These drawings having all been made from dried specimens, may not, when compared with recent ones be found quite correct, nor so full and explanatory as might be wished; the minuteness of the parts, and the delicacy of the structure of the flowers of this order, rendering their examination from preserved specimens extremely difficult.

XI.—CRUCIFERÆ.

The large assemblage of plants ranged under this order, forming one of the most natural families of the vegetable kingdom, have but few representatives within the tropics: scarcely 20 indigenous species, out of upwards of 1000 belonging to the order, being found within the tropical regions of India; and even these, being principally confined to alpine districts. The plants composing this order are for the most part herbaceous, rarely suffruticose, with watery juices; and round, or irregularly angled, stems. The leaves are simple and entire, or variously divided, rarely truly compound. The flowers hermaphrodite, regular, racemose, or rarely solitary and axillary.

Sepals 4, deciduous, cruciate, the lateral ones gibbous, or spurred at the base. Corolla hypogynous, cruciform, petals 4, alternate with the sepals, deciduous, stamens 6, the two, opposite the lateral sepals, shorter, and occasionally toothed, 4, in pairs, opposite the anterior and posterior sepals, longer: anthers bilocular, introrse. Torus with several glands between the petals and the stamens, and the ovarium. Ovary usually bilocular with parietal placentæ, generally, meeting in the middle, and forming a spurious partition, stigmas two opposite the placentæ. Fruit a siliqua or silicule, rarely one-celled and indehiscent, usually opening by two valves separating from the placentæ. Seeds attached in a single row, by a funiculus, to each side of the placentæ, generally pendulous. Albumen none, embryo with the radical folded up on the cotyledons : if on the edge they are said to be accumbent, if on the back incumbent, sometimes the cotyledons are folded, they are then said to be conduplicate incumbent, &c. (In Nasturtium they are accumbent, in Lepidium incumbent, the cotyledons in the latter 3-lobed.)

Affinities. The nearest affinities of this order are with *Capparideæ*, agreeing in the quaternary number of the divisions of the flower : in the fruit having two placentæ, and a similar mode of dehiscence ; and in the stamens of some species of the *Capparideæ*, agreeing in number. They have also some affinities with *Fumariaceæ* as already shewn under that order, but are kept distinct by the different structure of the seed.

Essential Character. Flowers polypetalous, stamens tetradynamous. Ovary wholly superior, the carpels combined into a solitary pistillum : seeds without albumen. Leaves alternate, destitute of stipules.

Geographical Distribution. I have remarked above that the species of this order are very rare within the tropics. Europe indeed may be esteemed the head quarters of *Cruciferæ ;* but they are abundant all over the temperate zone of the northern hemisphere, and comparatively rare in the southern : upwards of 600 appertaining to the one, and scarcely 100 to the other. But to enter into minute details of the geographical distribution of an almost extra Indian order in a work on Indian Botany, can be of but little avail ; I may however observe, that many are cultivated both for use and ornament in this country, and it seems not improbable, that the number might be increased, at least during the cool season, owing to most of them being annual, and requiring in this country but a few months to attain maturity. Whether attemps for their naturalization will ever so far succeed on the plains as to render us independent of more temperate climates for our supplies of seed, is a question still to be solved, but one, the solution which, when we consider their value to mankind, ought not to be readily relinquished, even though the chances against success, appear to preponderate. If this desirable object is ever to be accomplished, it must undoubtedly be through gradual extension from the more elevated and cooler regions, to the lower and warmer ones. One source of disappointment, viz. the oily nature of their seed, is not easily guarded against, as oily seeds generally soon deteriorate, and I presume more rapidly in a warm climate : while, owing to the long interval that intervenes between their arrival at maturity, and the period for sowing, they are exposed so much the more to this source of deterioration.

Properties and Uses. Acrimony, more or less combined with bitterness, forms the predominant quality of the *Cruciferæ,* in proof of which it is only necessary to mention, Horse-radish, Mustard, Cress, the common Radish, and Water-cress, all of which possess this property in an eminent degree, and even the cabbage, now so much used when ameliorated by cultivation, as aliment, possesses in its wild state much of the acrid properties inherent in the family. The principle on which their acrimony depends is of a volatile nature, and is greatly diminished by drying. Formerly it was attributed to the presence of volatile alkali, but careful chemical analysis proved the erroneousness of this opinion, by showing the total absence of ammonia, in the recent state of these plants, or in their expressed juices, though, during the process of putrefaction, it is exhaled in considerable quantity : hence it must be generated during decomposition, and is attributable to nitrogen, which enters largely into their composition. The more prevalent opinion now is, that their acrimony owes its existence to the presence of volatile oil, an opinion resting on a better foundation, though reasoning from analogy,

Rungia del. *W. Smith Lith.*

LEPIDIUM SATIVUM. (*Linn.*)

ஆளிவிரை *Aliverai.* — *Arabis Chinensis Rottler in Ainsl. Mat. med. Hind.* — [illegible]

Rungia del

NASTURTIUM MADACAGASCARIENSE. (*DC.*)

I strongly suspect not without some exceptions, as we do not in all the instances cited, find it combined with aromatic properties, any more than in *Ranunculaceæ*. It is said however, to exist not only in all the *Cruciferæ*, but in all parts of these vegetables, varying only in intensity. To this active, but very volatile principle, of whatever nature it be, they owe their medicinal virtues, which are stimulant and antiscorbutic, but which, requires, them to be used fresh, since it is lost by drying. The seed fortunately retain their properties for a greater length of time, and those of white mustard have been long celebrated for their tonic and stomatic virtues. The Tamul doctors attribute similar virtues to their Aliverie or Saliverie, the *Arabis chinensis* of Rottler and Ainslie, but which, I have ascertained to be merely the English Garden cress, *Lepidium sativum*, as may be seen from the accompanying plate, taken from a specimen raised in my garden from bazar seed.

Our cabbages, turnips, radishes, knolkoles, &c. which belong to this family, are all too well known to require notice here; they owe their fitness for food to their acrid properties being diluted by an abundance of mucilage. Several species, such as the rape and mustard, are cultivated in Europe on account of the oil which their seeds contain, but could never be profitably raised in this country for that purpose.

Under this head I shall only further observe, that one of the species here figured, which is not a native, was introduced for the purpose of determining to what genus, the so-called Aliverie actually belonged, and to assign to the proper plant, the merit which is its due. The other figure was made from a native specimen. Two species of the genus *Cardamine* are found truly native on both the Neilgherries and Pulney mountains, the *Capsella* (Sheepherd purse) is also found in abundance on the former of these ranges, but I suspect introduced with corn seed.

EXPLANATION OF PLATES 12 and 13.

12.—1. Plant of Lepidium Sativum—*natural size.*
2. Flower opened, to show the calyx, petals, stamens, and ovary.
3. Portion of a racime, with fruit.
4. Capsule before dehiscence. 5. The same burst, showing the seed *in situ.*
6. A seed cut transversely, showing the radical incumbent on the three 3-lobed cotyledons. 7. A seed cut longitudinally, showing the situation of the radical and cotyledons.
8 and 9. Different views of the radical and cotyledons removed from the testa, and partially opened out—*all more or less magnified.*

13.—1. Plant of Nasturtium Madagascariense—*natural size.*
2. Flower opened to show the different parts.
3. The same, sepals and petals removed.
4. Stamens back and front view.
5. Capsule. 6. The same cut transversely.
7. Placentæ after the valves of the Capsule have separated, showing the position of the seeds.
8. A seed. 9. The same cut transversely, showing the accumbent radical.
10. Embryo removed from the testa, showing the cotyledons and radical—*all more or less magnified.*

XII.—CAPPARIDEÆ.

The *Capparideæ* are chiefly a tropical family of herbaceous or fruticose plants, many of the latter climbing extensively, but not twining, having alternate, simple, and stipulate leaves, or compound and ex-stipulate ones, the stipules when present spinous. The flowers are pedicelled, either solitary or racemose, hermaphrodite, or rarely, by abortion, unisexual.

Calyx 4-sepaled, either partially united at the base, and 4-lobed, as in *Niebuhria*, or altogether free and imbricated in œstivation. The torns often occupies a conspicuous place in this order; sometimes, though rarely, it is even with the bottom of the calyx, more frequently it is free and elongated, together with thecaphore, elevating the ovary far above the calyx, on a filiform stalk or pedicel; or it is lateral, tubular, funnel-shaped, and netariferous, (forming the nectary of authors) bearing the thecaphore at its base: as in *Cadaba*. Petals 4, alternate with the lobes of the calyx, often with a long claw, as in *Cadaba*, deciduous. The stamens vary much in number and situation; sometimes there are only 4, as *Cadaba*; oftener very numerous, sometimes appearing to spring from the middle of the stalk of the ovary, as in *Gynandropsis*, oftener springing from the bottom of the calyx, and either altogether free, or united for a short distance round the torus. Ovary usually stalked, 1-celled with parietal placentæ, style filiform

or wanting. Fruit pod-shaped, or baccate, 1-celled, with numerous, rarely few, seeds: seeds generally reniform, exalbuminous, with a thickened testa, foliacious cotyledons, and a curved embryo.

Affinities. The herbaceous forms of *Capparideæ*, are allied to *Cruciferæ* by habit, by their quaternary sepals and petals, and some of them by their hexandrous stamens, which however are never truly tetradynamous; more generally the stamens are indefinite, and the seeds reniform, which form the principal marks of distinction between *Cruciferæ* and the herbaceous section of *Capparideæ*. The fruticose section is less likely to be confounded, the difference of habit forming of itself a good distinction. The stipitate ovary, so common in this order, is also met with in *Passifloreæ*, combined with indehiscent fruit and parietal polyspermous placentæ, but readily distinguished by other marks. The structure of the fruit and indefinite stamens associate them with *Flacourtianeæ*, from which, however, they are distinguished by their exalbuminous seed and different habit. With *Resedaceæ* they agree in having parietal placentæ, and reniform exalbuminous seed, but are separated by the different arrangement of their flowers.

Essential Character. Polypetalous, polyandrous, dicotyledons, with versatile anthers, the ovary wholly superior, and the carpels combined into a solid fruit, with more placentæs than one. Leaves alternate, ex-stipulate, or with spines in their place. Cadaba has 4; Cleome and Gynandropsis 6 stamens.

Geographical Distribution. This large order is nearly confined to the tropics, abounding in Asia, Africa, and America. They are more sparingly met with in New Holland, and two or three species are natives of Europe: among the latter, ranks the best known one of the order, the caper-bush, (*Capparis spinosia*) much cultivated in the south of Europe, on account of its flower-buds which, when pickled, become the much esteemed caper of commerce. Some of the herbaceous forms, are very widely distributed over the world, being found in Asia, Africa, and America. The shruby forms are more limited in their range, the species being usually confined to one of these countries. Some however, are, I believe, common to Asia and Africa. In India the *Capparideæ* are numerous, not only with reference to the number of species, but still more so with regard to individuals. Some of the herbaceous ones are our most common weeds, met with in every field, others occur in every piece of waste ground or neglected spot. Some of those belonging to the shruby subdivision of the order, are nearly equally common, such is the case with *Capparis horrida*, the rather handsome flowers of which, are at this season to be seen decorating almost every hedge. *Cadaba Indica* is very generally met with among rubbish, and almost every dilapidated Pagoda in the country, is more or less overgrown with this plant. It is also frequent in villages about ruinous mud walls. Of *Capparis sepiaria* and *incanescens*, I have seen whole jungles, and these of the most impenetrable kind, when thick, owing to their numerous sharp replexed thorns. In some situations the species of *Cratæva*, are nearly equally abundant, and when in flower, infinitely more ornamental, each branch terminating in large clusters of showy flowers. I have only however seen it attaining this degree of perfection near tanks or water courses, where the soil was rich and moist. They are however handsome plants in all situations.

Properties and Uses. The many points of affinity in structure between this order and *Cruciferæ*, have been already adverted to. In their properties they are equally allied, having like them an acrid volatile principle, highly stimulating and irritating when applied to the skin. The roots of the caper bush are stimulating and diuretic, like those of so many of the *Cruciferæ*, and the flower buds of *Capparis spinosa* (capers) are much esteemed in the south of Europe, where they grow, as an antiscorbutic. Some species of *Cleome* have an acrid taste, which has been compared, by many, to mustard. The leaves and succulent stems of *Polanesia (cleome) icosandra*, applied to the skin, excite inflammation, and are sometimes employed as a sinapism: in this country, the seed are administered as a carminative and vermifuge. The leaves of *Gynandropsis (cleome) pentaphylla* bruised, and applied to the skin, act as a rubefacient, and produce very abundant serous exudation, affording in many cases the relief derived

CAPPARIS FLORIBUNDA. *(R.W.)*

from a blister, without its inconveniences. This freedom from inconvenience is not however always experienced. I once saw extensive vesication produced by the application of the leaves of this plant, as a discutient, to an incipient boil. The previously existing inflammation of the skin probably gave rise to this excessive action. The root of *Crataeva gynandra*, a Jamaica plant, is said to blister like *Cantharides*. Dr. Ainslie in his Materia Medica, mentions six species of this order, as being employed in medical practice, but upon the whole gives very little information regarding them.

Remarks on Genera and Species. Roxburgh was acquainted with but a small number of the Indian species of this order, amounting in all to only 13, and these he distributed under three genera, viz. *Cleome*, *Strœmia*, and *Capparis*. The two first, most unaccountably, placed respectively in tetradynamea, and pentandria digynia: whether through errors of his Editors, or by his own arrangement I am unable to say. Dr. Wallich, (List of Indian plants) has greatly augmented the catalogue, which now extends to 42 species. DeCandolle, in his Prodromus, revised the genera, and by adopting the views of those who had previously subdivided the old genus *Cleome*, into three distinct genera, rendered the determination of species much easier, by making the genera themselves more natural. Of those having long pedicelled ovaries, with 6 long stamens, apparently springing from above the middle of the pedicel, he formed the genus *Gynandropsis*. Those having numerous stamens, and a nearly sessile ovary, now form the genus *Polanesia*: while all those having 6 stamens and a subsessile ovary, are retained to form the present genus *Cleome*. The Peninsular flora, presents examples of each of these forms. *Cadaba* as being an older name was substituted by DeCandolle for *Strœmia*. The species of the genus *Capparis*, (of Roxburgh's Fl. Ind.) are also distributed among three distinct genera, viz. *Capparis*, *Cratæva*, and *Niebuhria*. *Capparis* and *Cratæva* are both Linnæan genera, more readily distinguished by habit, and foliage, than by characters taken from the inflorescence. In *Cratæva* the petals are furnished with a slender claw, expanding above into a broad limb, and the leaves are 3 foliolate: while in *Capparis*, the petals are sessile, and the leaves simple, often with spinous stipules. *Niebuhria* is distinguished from both, by the sepals being united at the base, the petals wanting or shorter than the calyx, and by the elongated, irregularly torulose fruit, caused by the seed bulging out the sides of the berry, on either side of a rigid central placenta. Judging from the figures, as well as the description given of the genus *Mœrua* in the Flora Senigambiæ, it appears, that *Niebuhria* is identical with that genus, and hence *Mœrua*, being the older name of the two, must necessarily be adapted, on the ground of priority. Since my return to India in 1834, the following species have been added to *Capparis*.

CAPPARIS.

1 *C. floribunda.* (R. W.) Shrubby unarmed: leaves oval oblong, obtuse at both ends, glabrous: flowers numerous, umbelled; umbels axillary, numerous near the ends of the branches, and forming, through the abortion of the leaves, large terminal panicles: pedicels glabrous; calyx and petals ciliate on the margine: stamens eight, much longer than the petals and pedicel of the ovary: ovules several, pendulous, berry few, (1-3) seeded.

Apparently a beautiful shrub, which, however, I have not myself seen, the drawing from which the figure is taken, having been made by the draughtsman in the course of an excursion he made unaccompanied by me. The figure is defective, in so far as not distinctly showing the pedicelled ovaries in the flowers generally.

C. Moonii. (R.W.) Shrubby, diffuse, scandent, armed with short reflexed stipulary thorns: leaves oval, or a little broader below, mucronate at the apex, racemes terminal, leafless, corymbiform, pedicels 1-flowered—flowers very large.

C. grandis ? Moon. *Cat. Ceylon Plants.*

This species I found in Ceylon usually among clumps of jungle, in moist or even marshy soil. In such situations its large pure white flowers render it a very conspicuous object, and are seen from a great distance. It seems very nearly allied to *C. Roxburgii*, but judging from the description, and still more from specimens of what I consider his plant, is I think distinct. The leaves in this are nearly an exact oval, with an abrupt somewhat retuse mucro. The flowers which are white, nearly six inches across the filaments of the stamens, alone sometimes exceeding three inches in length. The fruit I have not seen.

EXPLANATION OF PLATE 14.

1. Flowering branch of Capparis floribunda.
2. Flower detached, showing the sepals, petals, stamens and ovary.
3. Ovary laid open, showing the pendulous ovules.
4. Anther—*all magnified.* 5. Fruit,
6. Cut transversely, showing a single seed—*natural size.* 7. Seed removed—*natural size.* 8. the same, cut vertically, showing the large embryo.
9. Embryo removed, showing its curved form and radical pointing to the hilum.

XIII.—RESEDACEÆ.

A small, extra tropical, order of herbaceous or suffruticose plants, with alternate, simple, entire, or pinnatifid, exstipulate, leaves ; hermaphrodite flowers, arranged in terminal racemes, having their pedicels furnished with bractoles.

Calyx 4 to 6 parted, persistent, slightly imbricated in œstivation. Petals usually equaling the number of sepals, hypogenous, deciduous, unequal, the larger ones behind, lacerated, with a broad claw. Stamens 10 to 20; free, not covered during œstivation. Torus short or resembling a stipes, usually bearing under the stamens, an obtuse nectariferous scale, Carpels 3 to 6, each with 1 style, distinct, or united into a single 1-celled ovarium, open at the apex ; placentas several, parietal, nerve-like, many-ovuled : ovules pendulous. Fruit either consisting of several follicles dehiscing internally, or of a unilocular polyspermons capsule, dehisciug at the apex. Seeds pendulous, testa crustacious: albumen thin : embryo curved, terate, radicle superior, cotyledons fleshy semi-cylindrical.

Affinities. The nearest affinity of this order is to *Capparideæ*, with which it has many points of agreement, such as the parietal placentæ, reniform seed, tapering curved embryo, &c. Also the l arge disk from which the stamens arise.

Geographical Distribution. This order is almost entirely confined to Europe. The specimen from which the accompanying figure was taken, was however gathered on the Neilgherries, and under circumstances that seemed to indicate its being a native, but I greatly fear that it is an introduced plant.

Properties and Uses. One species of *Resida*, (*R. lutiola*) is much cultivated in some parts of France, for the sake of a yellow dye which its roots produce ; it is also used in medicine as a vermifuge, though not much esteemed as such, while there are so many far superior to be had. *Resida odorata*, the *Mignionette*, is among the most fragrant of plants, and on that account, in spite of its very unpretending flowers, has received in France, the distinguished name of *Herb d'amour*. Some gardeners, by the application of heat to the pots, in which it is growing, during the winter, and lopping the primary branches, change its annual character and convert it into a pretty little shrub, in which form, it is much admired in France.

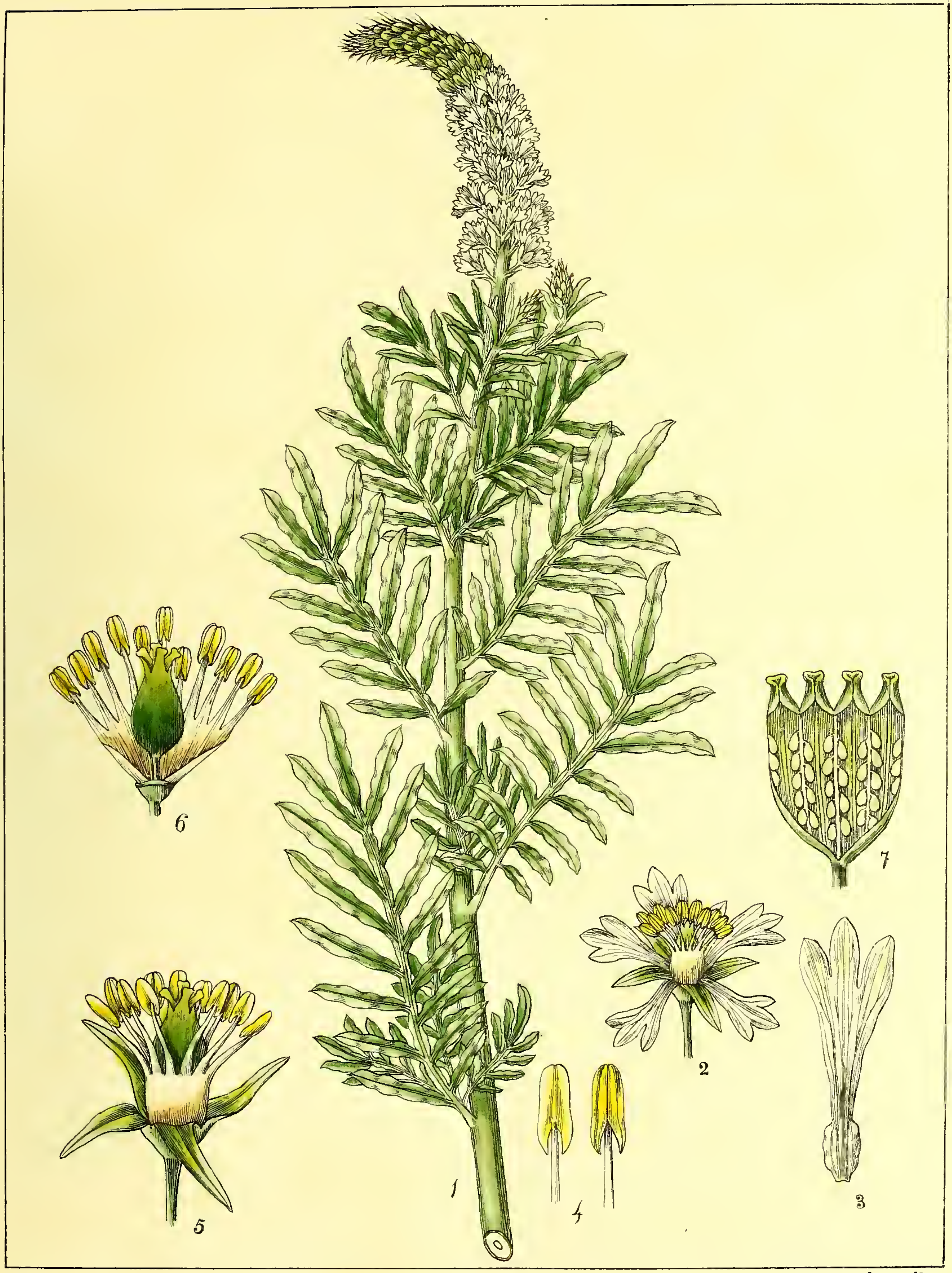
EXPLANATION OF PLATE 15.

1. Flowering branch of reseda alba—*natural size.*
2. Flower opened to show the relative position of the sepals, petals, and stamens.
3. A detached petal. 4. Anthers back and front view.
5. Stamens and ovary, showing the filaments united into a tube at the base, and concealing the pedicel of the ovary.
6. The same laid open to show the pedicel.
7. Ovary laid open, showing the parietal placentæ, and pendulous ovules.

XIV.—FLACOURTIANEÆ.

A small order, consisting of trees and shrubs, with alternate, exstipulate, simple, coriaceous entire or serrated leaves ; and axillary, solitary, or racemose, hermaphrodite or unisexual flowers.

Sepals from 4 to 7, cohering slightly at the base. Petals equalling them in number, and alternate with the sepals, sometimes wanting. Stamens inferior, either equalling the sepals, or some multiple of them, often very numerous, and occasionally changed into nectariferous scales. Ovary roundish, distinct, more or less stalked ; style either wanting or filiform ; stigmas several, more or less distinct, and spreading star-like on the apex of the ovary. Fruit 1-celled baccate and indihiscent, or capsular, and 4 or 5-valved, filled with thin pulp ; seeds irregularly attached to branched placentæ, spread over the surface of the pericarp, often enveloped in a pellicle of dry withered pulp. Albumen fleshy, somewhat oily. Embryo straight in the axis, with the radicle urned towards the hilum ; cotyledons flat foliacious.



Rungia del

Winchester. Lith

RESEDA ALBA. (*Lin*)

Affinities. According to DeCandolle, this order is allied to *Capparideæ*, and *Passifloreæ*, but is distinguished from both by the branched placentæ spreading over the whole of the inside of the fruit, a character so peculiar, that he considers it sufficient to distinguish them from all the other dicotyledonous orders. They certainly resemble *Capparideæ* in several particulars, but are sufficiently distinguished by their peculiar fruit, their albuminous seed, their straight embryo, and many of them by their unisexual flowers, which are of very rare occurrence in *Capparideæ*.

Essential Character. Potypetalous. Stamens either few, equalling the petals, or very numerous. Ovaries wholly superior, combined into a solid pistil, with the placentas parietal, spread over the whole inner surface—leaves without stipules. The petals are sometimes wanting, and the flowers often unisexual.

Geographical Distribution. Peculiarly a tropical order, nearly all found in the warmer parts of the East and West Indies. A few are found in Africa, one in Senegambia, one or more in Madagascar, two or three at the Cape, among which, I learn, is a species of *Phoberos*. Some are met with in the Eastern Archipelago, among which I believe is the genus *Hydnocarpus*, which Blume proposes to remove to his new order, *Pangiaceæ*.

Properties and Uses. But little is known of these. The young shoots and leaves of *Flacourtia Cataphracta* Roxb., which have the taste, but not the bitterness of *Rhubarb*, are considered astringent and stomachic, in the Circars, and are prescribed in cases of diarrhœa and general feebleness, while in Bahar, a cold infusion of the bark is used in cases of hoarseness : the infusion of *Fl. sepiaria* is considered useful in bites of snakes ; the bark rubbed with oil and made into a liniment is employed against gout on the Malabar coast.

The fruit of most of the *Flacourtias* are acidulous, and pleasant tasted. Those of *F. Ramonchi*, a Madagascar plant, but now occasionally met with in our gardens, are about the size, and have much the appearance and taste of our small black winter plums, and I am informed make an excellent tart fruit. A species of *Roumia* found in the Ceylon jungles has a fruit very similar to the above, and is prized in Colombo, where it has recently been introduced, on account of its fruit, which are about the size of large cherries, somewhat acidulous, with a very agreeable flavour. The fruit of both *Flacourtia sapida* and *sepiaria* which are common in our jungles, possess like the others, when fully ripe, a pleasant acid taste, and are very refreshing, as I have more than once experienced, to the heated and thirsty sportsman. The plant here figured presents a remarkable contrast to the rest of the order, since its fruit are poisonous, and are employed in Ceylon to poison fish, which afterwards become so unwholesome as to be unfit for food. On the Malabar Coast an oil is extracted from the seed which is employed as an external application in a variety of cutanious diseases, and in irritations affecting the eyes, causing an excessive flow of acrid tears. An anomaly so striking as that presented by the poisonous properties of this plant, compared with the salutary ones of the rest of the order, affords strong evidence, in support of the opinion of Blume, that this, and one or two other genera referred here, should be removed and united to form a distinct order, a course which he has followed, giving the name *Pangiaceæ* to the new order, from *Pangium*, one of the genera referred to it. As I have not seen his paper on the subject, I am unable to state his reasons for this determination, or to offer any opinion on their merits.

Remarks on Genera and Species. This is a small a order, 27 species only, referable to it, being known to DeCandolle when he published his Prodromus. The Number has been considerably augmented since then, partly owing its characters being now better understood, leading to several, previously doubtful genera, being placed in it, among these are Roxburgh's *Gynocardia*, now referred to *Hydnocarpus* and Louriro's *Phoberos* which seems to have been unknown to DeC. as it is not noticed. *Chaulmoogra* of Roxburghs (Fl. Ind. 3. p. 835) is evidently the same as *Gynocardia* of his Coromandel plants, about which, there is a curious, though unimportant, error in Dr. Lindley's Natural System of Botany, the one being referred, without a doubt, to *Flacourtianeæ*, and retained as one of the genera of that order ; while the other, is reduced to a synonym of *Hydnocarpus*, and referred to *Pangiaceæ*. The genus *Phoberos* of

Louriro which seemed to have been very imperfectly known, previous to the publication of our Prodromus, is now referred here, but not, it would appear, without leaving some grounds to doubt the correctness of this determination, since Dr. Lindley has placed it doubtfully at the end of the list of genera belonging to the order, which appears the more remarkable, as Dr. Wallich referred every one of our species to the genus *Flacourtia*, from which however it is well distinguished by its hermaphrodite flowers, and the curious prolongation of the connectivum beyond the cells of the anther. The genus *Oncoba*, an African genus which seems very closely allied to *Phoberos* in a number of particulars, has been, by Dr. Lindley, placed among the *Bixineæ*, whence I infer it is the near affinity existing between these two genera, that has induced him to view *Phoberos* as a doubtful member of this order. Of the genus *Roumia*, Col. Walker has found a species in Ceylon, which however I refrain from designating as I have considerable doubts of the stability of the genus, and have not at present the means of clearing them up. Of the genus *Phoberos* Ceylon produces one or two species, and at Courtallem, I met with one which attains the size of a pretty large tree. I am still uncertain whether to consider this one as distinct from *R. Wightianus*, a Neilgherry plant, as the difference of station may perhaps have caused the difference in appearance existing between them.

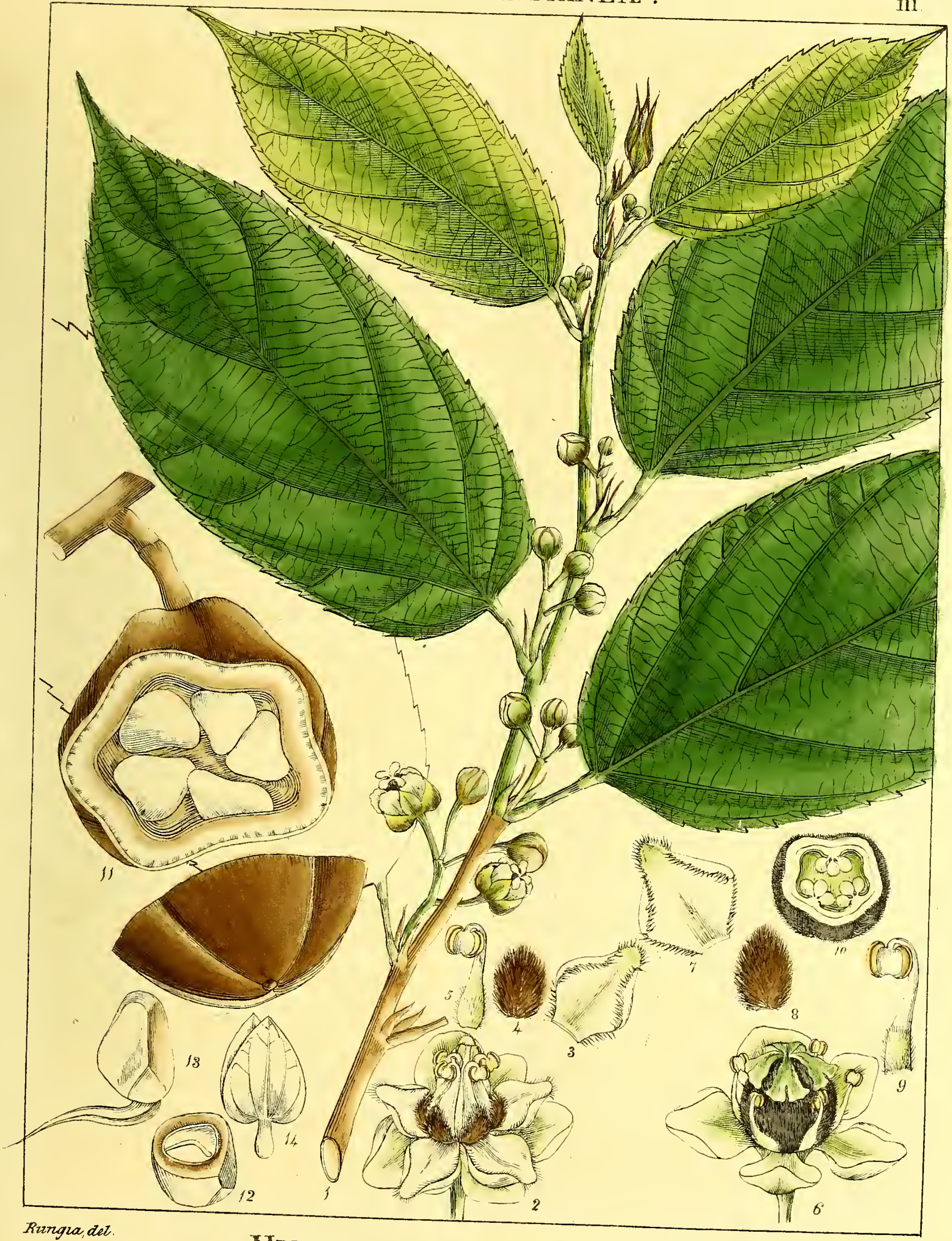
EXPLANATION OF PLATE 16.

1. Flowering branch of Hydnocarpus inebrians female—*natural size.*
2. *Male* flower, showing sepals, petals, scales and stamens.
3, 4, 5. Petal, scale, and stamen detached.
6. *Female* or fertile flower, showing the sepals, stamens, ovary and stigma. The stamens in this figure are placed alternate, in place of opposite the sepals, which is an error of the draughtsman overlooked at the time of making the drawing.
7, 8. Petal and scale detached.
9. Stamen of the female flower, the anthers are empty of Pollen.
10. Ovary cut transversely, showing in that instance three placentæ, they vary in number, and I have seen as many as 6 in one ovary, they correspond with the number of lobes of the stigma.
11. A small but full grown fruit, cut transversely to show the seeds which are surrounded with thin viscid pulp.
12. Seed cut transversely.
13. A seed which had begun to vegetate, showing the young radicle.
14. Embryo removed, showing the foliacious cotyledons and radicle.

XV.—BIXINEÆ.

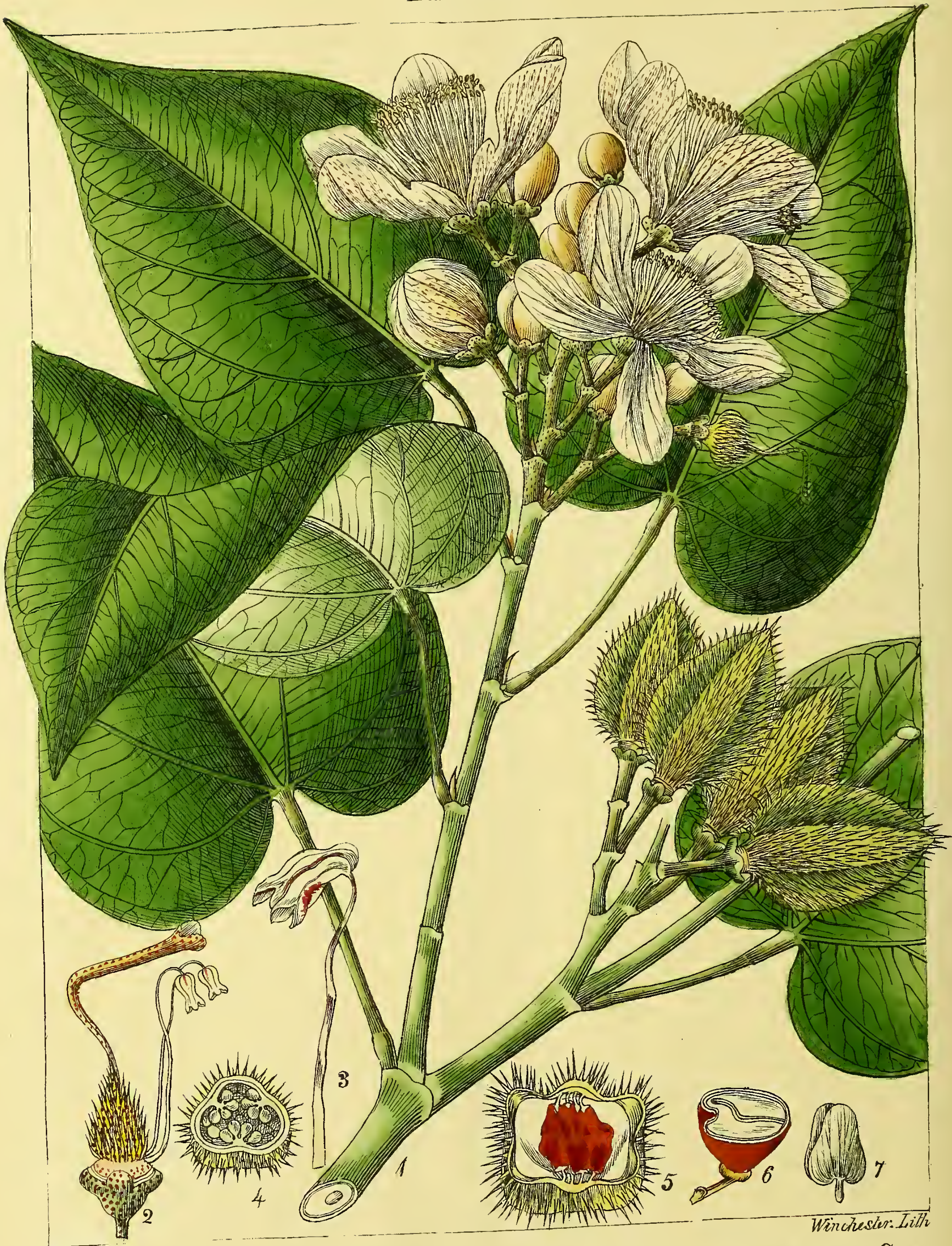
A small order, of tropical plants, consisting of trees and shrubs, with alternate, simple, entire, petioled, leaves; often with pellucid dots: deciduous stipules: and axillary, solitary, or congested, hermaphrodite flowers. Calyx, 4 to 7-sepaled, Petals 5 hypogynous. Stamens indefinite, distinct; anthers 2-celled, opening by pores at the apex, inserted on a diskoid torus. Ovary superior, sessile, 1-celled, with the ovules attached to, from 2 to 7 parietal placentæ, surmounted by a single 2 to 4-cleft style. The fruit is either capsular or baccate, containing numerous seeds, enveloped in pulp, which in *Bixa* is farinaceous and coloured. The seeds are albuminous; the albumen either fleshy or very thin, enclosing the straight or curved embryo: cotyledons leafy, radicle pointing to the hilum.

Affinities. The extent and affinities of this order seem as yet imperfectly known; Botanists being much divided in opinion both as to the genera that ought to be referred to it, and as to whether it ought to be retained as a distinct order. Kunth first established the order, and has been followed by DeCandolle, Lindley, and others. Don, proposes to adopt the name *Prokeaceæ* for it, and remove *Bixa* and one or two others from it to be formed, as I understand, into a distinct order. Richard in the Flora Senegambiæ, proposes the junction of *Bixineæ* and *Flacourtianeæ*, Lindley still keeps them distinct, but remarks of *Oncoba*, the genus which led to M. Richards remark, "that it connects the order with *Flacourtianeæ*, and seems equally allied to both, it also joins both that, and this present order to *Passifloreæ* by the genus *Smeathmannia*, with which it accords in habit." Mr. Don's proposal seems so far just, as the genus *Bixa* wants the pellucid dots in the leaves, which form an important item in the character of the order; so much so indeed, that it has been remarked of them, that they are so "re-



Rungia, del.

HYDNOCARPUS INEBRIANS.



Rungia del

Winchester. Lith

BIXA ORELLANA (*Linn*)

மஞசணுததிமரம . } *Tam*
Munge.nātie. marum. }
Gawpurgee . Hind .

Kuppa-manhala. Canar.
Lut-kun .... Bing.

markable among all the neighbouring orders, that they would alone suffice to characterize this if they were constant." Dr. Lindley refers *Oncoba* to *Bixineæ* and *Phoberos* doubtfully to *Flacourtianeæ,* though these genera, are so closely allied, that their principal difference seems to be in the presence of petals in the former, and their absence in the latter. In both the stamens are attached to an expanded torus, in both the anthers are apiculate from the prolongation of the connectivum, in both the flowers are hermaphrodite, the style long, with a capitate stigma, and in both the ovary is 1-celled. The two genera agree besides in their arborious habit, and the character of their foliage To whichever order, therefore the one belongs, the other I conceive must of necessity be referred. If therefore the genus *Bixa* and *Oncoba* can be correctly associated in the same order, which I doubt, I confess myself unable to perceive on what grounds, without taking *Phoberos* with it, *Oncoba* can be severed from the *Flacourtianeæ.* The small number of Indian species referable to *Bixineæ,* as it now stands, not permitting me to enter more minutely into an examination of the characteristics of the order, I must of necessity leave it as I find it, but would suggest to those who have better opportunities, a more careful examination of the various genera respectively referred to it and *Flacourtianeæ,* than they seem yet to have been subjected to, with a view to a more exact determination of their limits.

Geographical Distribution. *Bixa* is a native of America, but has long been naturalized in India, and so completely on the Malabar Coast, that it is now believed to be originally a native of that part of country, it is equally found in the islands of the Eastern Archipelago. *Echinocarpus* and *Trichospermum* are natives of Java, and of the former, one species, I believe a new one, has been found in the vicinity of Bombay. *Oncoba* is a native of Africa, nearly all the others are natives of the warmer parts of America and the Mauritius.

Properties and Uses. The medicinal properties of the order, if they possess any, are of little note, annotto or arnotto, (the pulp surrounding the seeds of *Bixa orellana*) is sometimes administered as a gentle laxative, and stomachic, but is much more extensively employed as a dye. " It is prepared by macerating the pods in boiling water, extracting the seeds, and leaving the pulp to subside; the fluid being subsequently drawn off, the residuum, with which oil is sometimes mixed up, is placed in shallow vessels and gradually dried in the shade. It is of two sorts, viz. flag or cake, and roll annotto. The first, which is by far the most important article in a commercial point of view, is furnished almost wholly by Cayenne, and comes to us principally by way of the United States. It is imported in square cakes, weighing 2 or 3 lbs. each, wrapped in banana leaves. When well made, it ought to be of a bright yellow colour, soft to the touch, and of a good consistence. It imparts a deep but not durable orange colour to silk and cotton, and is used for that purpose by the dyers. Roll annotto is principally brought from Brazil. The rolls are small, not exceeding 2 or 3 oz. in weight; it is hard, dry, and compact, brownish on the outside, and of a beautiful red colour within. The latter is the best of all ingredients for the colouring of cheese and butter; and is now exclusively used for that purpose in all the British and in some of the continental dairies. In Gloucestershire, it is the practice to allow an ounce of annotto to a cwt. of cheese; in Cheshire, 8 dwts. are reckoned sufficient for a cheese of 60 lbs. When genuine, it neither affects the taste nor the smell of cheese or butter. The Spanish Americans mix annotto with their chocolate, to which it gives a beautiful tint."

" At an average of the three years ending with 1831, the annotto entered for home consumption amounted to 1,28,528 lbs. a year. Previously to 1832, the duty on flag annotto was 18*s.* 8*d.* a cwt., and on other sorts £5 12*s.*; but the duty is now reduced to 1*s.* a cwt. on the former, and to 4*s.* on the latter. This judicious and liberal reduction will, we have no doubt, be followed by a considerable increase of consumption. The price of flag annotto varies in the market from 6*d.* to 1*s.* per lb., and of roll from 1*s.* to 1*s.* 6*d.*" *McCulloch's Dictionary of Commerce, page* 41.

Mr. Huxham a talented and enterprising merchant on the Malabar Coast, attempted the preparation of Annotto for exportation, but found the low price at which it can be produced in America, set competition from this country at defiance, though the shrub grows freely, produces fruit abundantly, and pulp of good quality. It is employed in this country as in Europe, to tinge butter, and a good deal as a dye, for the production of a pale rose colour. The cloth is

prepared by being first soaked in strong alum water, the colour is then suspended in butter-milk, into which the cloth is dipped and charged with colour. The colour so imparted soon fades, and requires to be renewed from time to time, by a repetition of the above simple process.

XVI.—VIOLARIEÆ.

A large and widely distributed order, its species being found in almost every part of the world, but most abundantly in America. A few only have as yet been found in tropical Asia. Those of India, like the European ones, are all diminutive herbs or suffruticose plants, but the American ones attain the size of considerable shrubs or even small trees. The leaves are usually alternate, stipulate, simple: the flowers erect, or spreading peduncled: the peduncles solitary, or several together, 1-flowered, with two bractioles. The calyx consists of 5 persistent sepals, imbricated in œstivation: the Corolla of 5 inferior petals, sometimes unequal, usually withering and obliquely convolute in œstivation: the Stamens 5, alternate with, rarely opposite, the petals, inserted on an inferior disk, often unequal, with the anthers sometimes co-hering, lying close on the ovary, 2-celled, opening inwardly, and tipped with membrane; two of the filaments in the irregular flowered ones, furnished with an appendage or gland at the base: the Ovary 1-celled, usually many seeded, with 3 parietal placentæ, opposite the three outer sepals; Style single, declinate, with an oblique hooded stigma: Capsule, 3-valved loculicidal, bearing the placentæ on the middle of the valves: seed often carunculate at the base, having a straight, erect, embryo in the axis of a fleshy albumen.

Affinities. *Polygaleæ* and *Droseraceæ*, are considered by DeCandolle and others the orders most nearly allied to this, which however can only be with reference to the extreme forms, which are not met with in India. The Indian genera can scarcely be confounded with them, the *Violarieæ* being all furnished with a 3-valved capsule, bearing the placentæ, and numerous seed on the middle of the valves. While in *Polygaleæ*, except *Xanthophyllum*, which has an indehiscent fruit, the capsule is 2-celled, with a single pendulous seed in each cell, and the *Droseraceæ* have several styles, cercinate vernation, and ex-stipulate leaves. The most nearly allied orders so far as the Indian flora is concerned, being thus easily distinguished, it is unnecessary to enter further on their distinctive marks, with reference to those of other countries.

Essential Character. Polypetalous: stamens fewer than 20: ovary superior of several carpels, combined into a single capsule, with more placentas than one. Leaves dotless, straight when young, furnished with stipules.

Geographical Distribution. As already observed the species of this order are met with in every part of the world, but certainly predominate in America, and there they attain their greatest development; large shrubs and even moderate sized trees being found among the American representatives of the order. In Europe, as in India, the forms of *Violarieae* are either herbs or small shrubs, the latter however, with much smaller flowers than is usual in the former. Of the whole number of known species of the order, the Indian flora, taking Wallich's list as the standard, contains about 1-10th. These are referable to three genera, viz. *Viola*, *Ionidium*, and *Pentaloba*, the latter genus as yet unobserved in the Peninsula. Of these, the species of *Viola* always occupy alpine situations, while the two species of *Ionidium*, are both natives of the plains. *Pentaloba* is found in Bengal and in Cochin China; species of *Viola* and *Ionidium* are also found in Java.

Properties and Uses. Under this head we possess little information derived from Indian experience, two species only being met with on the plains, and these small plants, but little regarded. They are however members of a genus (*Ionidium*) remarkable for the number of its species, endowed with rather strong emetic properties, so much so indeed is the case with some of them, that it was long supposed the tree *Ipecacuana* was derived from one of them,

which hence got the name of *Viola (Ionidium) Ipecacuana*, and in Brazil they are said t be in common use as emetics. Those of this country are not stated by Ainslie to have any such properties, but he speaks of the leaves and young shoots as being demulcent, and adds, that formed into a liniment with oil, the natives esteem them a cooling application to the head after exposure to the sun, and I am informed that the leaves and young shoots are eat as a cure for ardor urinæ and gonorrhœa. On the continent of Europe, decoctions of the sweet smelling and pansy violets, are extensively employed for the cure of cutaneous affections, particularly of children: whether our alpine violets, of which our hills produce several species, will be found suited for such purposes remains to be determined.

M. Boullay (*Jour. de Pharm.* X, 23) discovered in the *Viola odorata* an alcaloide, so analogous to *emetine*, that he called it *emetine de violette*, or VIOLINE. He considers it not as identical with that procured from Ipecacuana, but as a species of the same genus. He obtained it in two states; 1st. *Impure violine*, combined with malic acid, in form of yellowish brown deliquescent scales, very soluble in alcohol. Of this a pound of violet roots treated with alcohol, furnished about 4 drachms. 2d. *Pure violine*. The taste is bitter, very acrid, and disagreeable; it is in form of a white powder; little soluble in water, but more so than emetine, less soluble on the contrary than it in cold alcohol, insoluble in æther, and in the fixed and volatile oils. It combines with acids but does not form well characterized salts. It possesses strong emetic and purgative properties, but was found when tried, very uncertain in its operation, and was never admitted into practice: but the fact of one of the least active of the order being endowed with such properties, affords strong grounds for inferring that most of the others possess them in a greater or less degree.

REMARKS ON GENERA AND SPECIES. As there are only two genera of this order found in Southern India, a species of each of which is here figured to show their distinctive characters, it appears unnecessary to advert here to their generic characters. Specific characters however are not so easily made out, owing to their disposition to vary, under this conviction, I was at first led to conclude that the species here figured, was one of the numerous varieties of *Viola Patrinii*, and it was not until I had examined, with much care, a great number of specimens, procured from different localities, I became sensible of my error, by observing that, however much they varied in other respects, they all agreed in having winged-leaf stalks. The absence of that character, combined with the whole under surface of the leaves of this one, being covered with short hairs, (in *V. Patrinii* they are confined to the veins only,) aided by its remote place of growth (Ceylon) induced me to take a different view, and consider it a new species. *Viola Patrinii* except in the characters above alluded to is most variable. In some of my specimens the petiols are shorter, others longer than the limit of the leaf, and the leaves in place of being always truncated are occasionally cordate at the base, in others the petiols are nearly a foot long, surmounted by triangular leaves, not above an inch and a half in their largest dimension, while in a third form the leaves more nearly approach to lanceolate, that is, they taper at the base; but still the winged petiol is invariably present. These various forms are derived from the Neilgherries, Pulney mountains, and Shevaroy hills—the very large ones are from the last named station. The relative length of leaves and peduncles do not afford good distinctive marks, the one being sometimes longer, sometimes shorter, than the other. To the species here figured may probably be referred the *Viola hastata* of Moon (Cal. Ceylon plants). The species variously named *Viola serpens*, *V. aspera*, *V. crenata*, *V. Wightiana*, and *V. palmaris*, are I suspect only varieties of one species, and feel almost certain, that my collection presents representatives of each. though I am unable to distinguish two well marked species among the whole, without however wishing for the present to do more than call attention to the subject, I may observe, that characters taken from the comparative lengths of petiols and peduncles, are scarcely fit to determine specimens of the same plant for they vary in their relative proportions on different parts of the same specimen, neither do I think, are good characters to be obtained from the stipules or bractioles, which appear to be nearly the same through the whole series. The degree of hairiness is equally variable even on the same plant, apparently depending on different degrees of luxuriance, the early leaves, expanded under the influence of a moist soil and atmosphere, being sometimes nearly glabrous, while others developed at a latter period, probably during dry weather, are decidedly hairy. Again they

all agree in their sarmentose habit and cordate leaves, but the form of the leaves differ, for sometimes they are broadly reniform cordate at the base, and obtuse at the apex; others are simply cordate, with a tendency to accumination at the apex, while in others they are distinctly accuminated and very sharp pointed: some specimens have acutely serrated leaves, others crenated, while in others again they are almost entire on the margine. The series of specimens upon which these observations are made were derived from the Neilgherries, Pulney mountains, Shevaroy hills, Shevagherry hills, and Ceylon, to which I may add, that Mr. Royle's figure of the Himalayan form, perfectly corresponds with my native specimens derived from the above localities. The following characters will, I hope, sufficiently distinguish the new species from *V. Patrinii.*

Viola Walkerii. (R. W.) Stemless, leaves oblong, cordate at the base, crenate, petiols short, wingless: peduncles much longer than the leaves, stigma margined.

I have dedicated this species to Col. Walker from whom I first received specimens, and from one of which the accompanying figure was taken.

Viola Patrinii (D. C.) Stemless, leaves truncated at the base, from oblong, to nearly triangular, sometimes longer (but usually much shorter) than the petiol, petiols winged.

Neilgherries, &c. The peduncles being either longer or shorter than the leaves, I have not referred to them in the character.

XVII.—DROSERACEÆ—THE SUN-DEW TRIBE.

A small order of herbaceous, annual, or perennial, rarely suffrutescent plants, with simple, rarely pinnatifed or toothed, alternate, leaves, often congested at the base, for the most part furnished with scattered glandular hairs, especially on the margins, and with circinate vernation, the leaves being rolled inwards from the apex towards the base like ferns, stipules wanting, but in their place often furnished with stipulary hairs at the base of the petiols. Their flowers are hermaphrodite, regular, either solitary, or more frequently racemose, pedicelled, all ranged on one side of the stalk, (secund) the stalk circinatety revolute before the expansion of the flowers. The calyx free, persistent, consisting of 5 equal imbricating sepals: the corolla of 5 hypogynous equal petals, which continue to adhere and wither on the stalk after blooming, (marcescent.) The stamens usually equal the petals, and alternate with them, but are sometimes double or treble the number, with terminal, erect, 2-celled, anthers; bursting longitudinally, or rarely, by terminal pores. The ovary is sessile, 1-celled, with parietal many seeded placentæ, styles 3-5 distinct, or co-hering at the base, with bifid or branched stigmas. Fruit capsular, 1-celled, 3-5 valved, dehiscence loculicidal, that is the valves bearing the placentæ, and seeds on their middle. Seeds numerous, minute, albumen fleshy or cartilagenous, enclosing the straight Embryo, with its radical pointing towards the hilum: cotyledons thick, becoming foliacious in germination.

Affinities. This order is nearly allied to *Violarieæ,* from which however it is distinguished by its circinate vernation, ex stipulate leaves, and numerous styles. Dr. Lindley considers them also related to *Saxifrageæ,* from which they are principally distinguished by their vernation. He however refers *Parnassia* to that order, though it agrees with *Drosera* in its vernation, and in so far differs from *Saxifrageæ,* this therefore, as an intermediate genus, appertaining more to the one in its reproductive organs and to the other in habit, establishes a close relationship between the two.

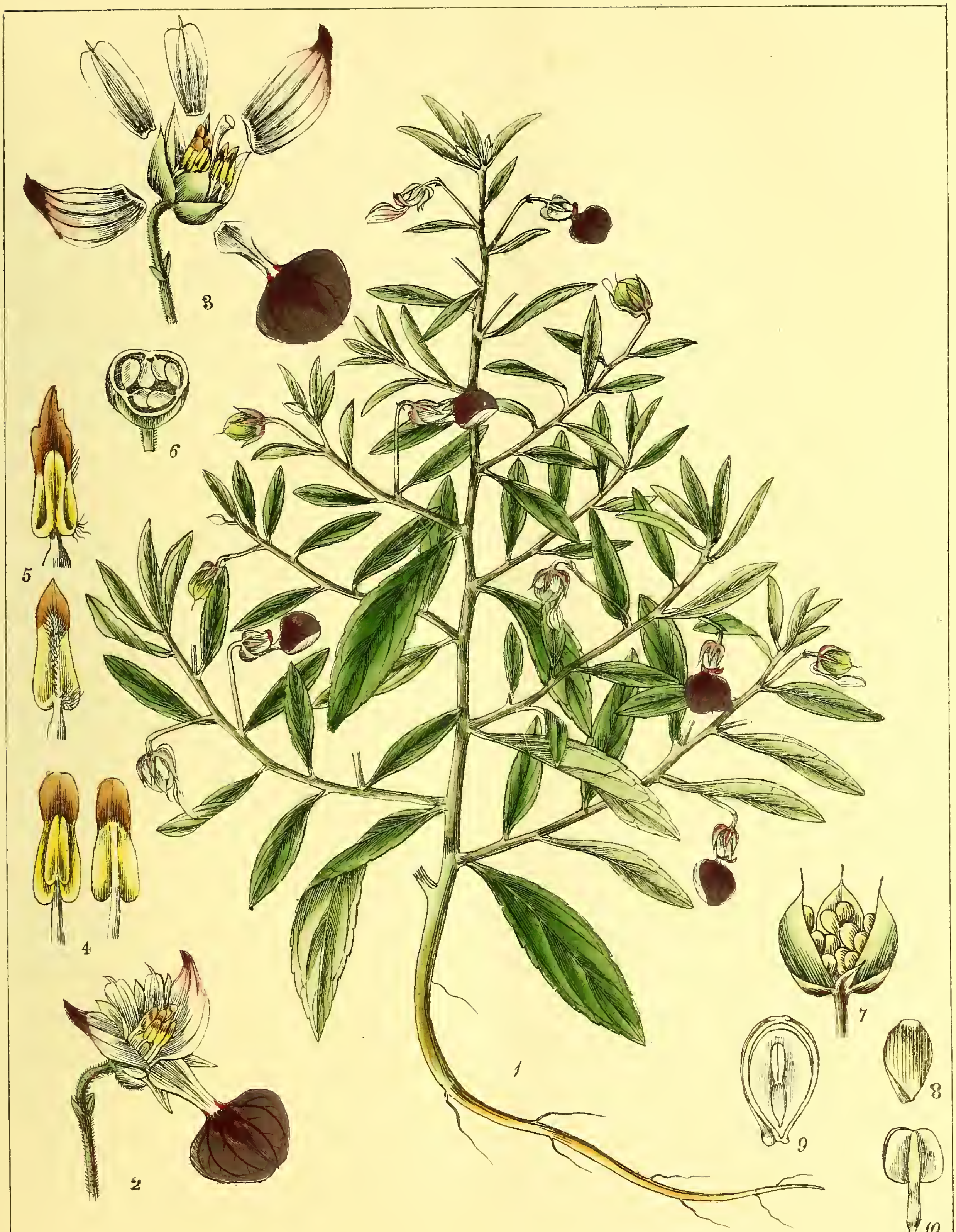
Essential Character. Polypetalous: stamens fewer than 20: ovary wholly superior; of several combined carpels with more than one placentæ: leaves with stipulary fringes, circinate when young, dotless.

Geographical Distribution. The whole order, with I believe only one exception, are natives of wet and marshy soil, and are found in every part of the world where bogs and marshes occur. In this country we find the *Drosera Burmanni* occupying a range of elevation, varying from that of the level of the sea, to 8000 feet. I have gathered it on the banks of the Adyar in Madras, and in the marshes of Ootacamund on the Neilgherries: *Drosera Indica* has nearly

Rungia del

Winchester. Lith

VIOLA WALKERII (R. W.)



Rungia del — Winchester. Lith

IONIDIUM SUFFRUTICOSUM.

ஓரிலைத்தாமரை
Oorilatamàray.

పురుషరత్నం
Poorusharatnum

as wide a range: *D. pelata* I have only found on the higher hills, but on these, both on the continent and in Ceylon: *D. intermedia* is a European plant, but the specimen figured in the accompanying plate was procured from an Indian herbarium, but whether a native specimen or not is unknown.

Properties and Uses. These plants were formerly esteemed by alchymists, on account of the drops of pellucid dew, which they support on the glandular points of their hairs, to which they gave the name of *Ros solis*, whence the name *Sun-dew* which they now bear. They are inodorous, but somewhat acid and acrid. Bruised with salt and applied to the skin, they are said to blister it: mixed with milk they curdle it; probably through their acidity: cattle refuse them, hence they are, apparently with much justice, supposed to be poisonous or otherwise injurious to them. *Drosera peltata*, which becomes nearly black in drying, tinges the paper in which it is kept a beautiful pink colour, and might probably as Mr. Royle suggests, afford a valuable dye. The whole of these plants are remarkable for their property of contracting on such insects, as happen to light on their leaves, but none of them to the same extent as those of *Dionœa muscipula*, (Venus' fly trap) which on some hairs in the middle of the lobes of the leaf being touched, immediately contract with great rapidity on whatever object may have excited them, but so long as these hairs are avoided, the surface of the leaf may be freely touched without exciting contraction.

Sub-ord. PARNASSIEÆ.

The place the genus *Parnassia* ought to occupy in the natural arrangement of plants, has long been a subject of doubt among Botanists. Jussieu placed it along with *Drosera* and *Resida*, at the end of the *Capparideœ* as allied genera, being principally influenced in this decision by the parietal placentation. Since then both *Drosera* and *Resida* have been made the types of distinct orders, but the place of *Parnassia* still remains undetermined. DeCandolle refers it with doubt to *Droseraceae*, Dr. Lindley to *Saxifrageae*, notwithstanding its circinate vernation, considering the nectarial scales as " a peculiar development of an hypogynous disk, which assumes the form of 5 fringed scales alternate with the stamens, and of highly curious structure." Bartling (*Ordinus Naturalis Plantarum*) thinks it more appropriately placed among the *Tamariscineœ*, while Dr. Arnott, in my opinion, with greater justice, considers it a sub-order of *Droseraceœ*, and here accordingly I have kept it for the present, though it differs from both orders, in the want of albumen in the seeds, and from *Droseraceœ* in the want of glandular pairs on the leaves. The following character of the sub-order was drawn up by Mr. Arnot and published in our Prodromus.

Sub-order. Parnassieœ (Arn.) Sepals 5; œstivation imbricative. Petals 5, alternate with the sepals, hypogynous. Stamens hypogynous, 10—20, some of them often sterile: anthers bilocular, bursting longitudinally. Ovary solitary, unilocular: style none, and four sessile stigmas opposite the placentæ; or one with a lobed stigma. Fruit a capsule, 1-celled, 4-5, valved and loculicide; or indehiscent, and then the placentæ is only at the base. Seeds numerous. Albumen 0. Embryo erect, or the radical pointing to the hilum. Bog plants. Leaves nearly all radical, without glandular hairs.

Geographical Distribution. The species of this genus are widely distributed, being met with in every country of Europe, North America, and on the higher hills of both the north and south of India; always in boggy marshy places. The three species figured here are respectively from the Pulney mountains, (*P. mysorensis*), the Neilgherries, (*P. Wightiana*), and from the Himalayas, (*P. nubicola*).

Properties and Uses. Of the properties of this order little is known, the *P. palustris*, when fresh, is somewhat bitter, which it loses by drying, the infusion is also said to be rough and astringent to the taste, and strikes a deep red colour on being mixed with sulphate of iron. In the northern parts of Europe and Siberia, the decoction is a popular remedy for retentions of urine and calculus disorders.

The following Synopsis of the East Indian species *Drosera* and *Parnassia*, drawn up by Dr. G. A. Walker Arnott, and published in the Companion to the Botanical Magazine, I republish entire, that work being but little known in India.

SYNOPSIS OF THE EAST INDIAN SPECIES OF DROSERA AND PARNASSIA.

BY G. A. WALKER ARNOTT.

DROSERA. *Linn.*

§ 1. ROCELLA. *D C.*

1. D. *umbellata* (Lour.); acaulis, foliis ovalibus longe petiolatis, scapo apice umbellato 5-floro.—*Lour. Coch.* (*ed. Willd.*) 1. *p.* 232. *D C. Prod.* 1. *p.* 317. *Don in Mill. Dict.* 1. *p.* 344.

HAB. In China.

This I have not seen, nor am I aware of its existence in any Herbarium. Loureiro himself had never found either the recent flowers or the fruit, and is somewhat doubtful about the genus, although the appearance was that of a *Drosera.*

2. D. *Burmanni* (Vahl); acaulis, foliis cuneato-obovatis sessilibus reticulato-venosis, scapo paucifloro erecto capillari calyceque glabris, seminibus exarillatis.—*Vahl, Symb.* 3. *p.* 50. *D C. Prod.* 1. *p.* 318. *Don in Mill. Dict.* 1. *p.* 344. *Roxb. Fl. Ind.* 2. *p.* 113. *Moon, Cat. Ceyl. Pl. p.* 23. *Wight et Arn. Prod. Fl. Pen. Ind. Or.* 1. *p.* 34. *Wall. Cat. n.* 1242. *Wight Cat. n.* 120.—*Burm. Th. Zeyl. t.* 94. *f.* 2.

HAB. In Ceylon. *Hermann, Burmann, Moon, Macrae, Walker.* Peninsula of India. *Roxburgh, Heyne, Klein, Wight, Griffith.* Bengal and Silhet. *Wallich, Hamilton, De Silva.* Cochinchina? *Finlayson.*

3. D. *Loureirii* (Hook. et Arn.); acaulis, foliis oblongo-spathulatis a petiolum subæque longum pilosum attenuatis, scapo adscendente elongato plurifloro folia multo superante versus apicem calyceque glanduloso-pubescentibus, pedicellis calycem æquantibus, seminibus exarillatis.—*H. et A. in Bot. Beech. Voy. p* 167. *tab.* 31.—D. rotundifolia. *Lour. Coch.* (*ed. Willd.*) 1. *p.* 233.—D. Burmanni. *D C. Prod.* 1. *p.* 318 (quoad plantam Chinensem).

HAB. Cochinchina. *Loureiro.* Canton, China, *Messrs. Lay and Collie.*

4. D. *Indica* (Linn.); caule ramoso, foliis sparsis anguste linearibus apice attenuatis glanduloso-pilosis, pilis limbi latitudine longioribus rigidiusculis, petiolo brevi glabro vel minute puberulo latitudine limbum folii subæquante, racemo paucifloro calyceque copiose patentim glanduloso-pubescentibus, seminibus exarillatis.—*Linn. Sp. p.* 403. *D C. Prod.* 1. *p.* 319. *Don in Mill. Dict.* 1. *p.* 346. *Roxb. Fl. Ind.* 2. *p.* 113. *Moon, Cat. Ceyl. Fl. p.* 23. *Wight et Arn. Prod. Fl. Pen. Ind. Or.* 1. *p.* 34. *Wall. Cat. n.* 1244. *Wight, Cat. n.* 119.—*Rheed. H. Mal.* 10. *t.* 20. *Burm. Zeyl. t.* 94. *f.* 1.

HAB. Ceylon. *Hermann, Burmann, Moon, Macrae, Walker.* Peninsula of India. *Roxburgh, Klein, Heyne, Wight, Campbell.* Tavoy. *Gomez.*

5. D. *Finlaysoni* (Wall.); caule ramoso, foliis sparsis anguste linearibus longe subulato-attenuatis supra margineque breviter articulato-pilosis, petiolo subæqui-lato brevi, racemis elongatis multifloris minutissime parceque glanduloso-puberulis, seminibus ovoideis scrobiculato-punctatis. *Wall. Cat. n.* 3752.

HAB. Turow Bay, Cochinchina. *Finlayson.*

This is much larger than the preceding, and presents a considerable difference in habit, but approaches too closely in character. I have only seen one specimen, and that an imperfect one.

§ 2. ERGALEIUM. *D C.*

6. D. *lunata* (Ham.); caule erecto glabro, foliis radicalibus rotundato-reniformibus, caulinis sparsis petiolatis peltatis lunato-triangularibus, angulis duobus acuminatis tertio rotundato, sepalis lacero-dentatis ciliatisve cæteroquin glabris, seminibus exarillatis.—*Ham. in D C. Prod.* 1. *p.* 319. *Don Prod. Fl. Nep. p.* 212. *G. Don. in Mill. Dict.* 1. *p.* 346. *Moon, Cat. Ceyl. Fl. p.* 23. *Wall. Cat. n.* 1243.—D. Peltata. *Wight et Arn. Prod. Fl. Pen. Ind. Or.* 1. *p.* 34. *Wight, Cat. n.* 117.

HAB. Ceylon. *Moon, Walker.* Peninsula of India. *Wight.* Nepal. *Hamilton, Wallich.* Himalayah. *Gerard.* Silhet. *Bruce.*

Although I have here kept *D. lunata* distinct from *D. peltata*, I do so with much hesitation; and the doubts, expressed by Dr. Wight and myself in the Prodromus Fl. Penins., are somewhat confirmed by specimens from Van Diemen's Land, agreeing entirely with the above character. The only difference I can point out between the two species is, that in our plant the calyx is glabrous; the margin is usually slightly cut or toothed, although sometimes ciliated. In *D. peltata* the calyx is all over covered with adpressed longish hairs, and the sepals are broader and shorter than in *D. lunata.* If they be really distinct species, it is not easy to say to which Smith's and Labillardière's synonyms belong.

PARNASSIA, *Linn.*

This genus may be conveniently divided into four groups, two of which belong to Europe, N. America, and Siberia; the other two to East India. I shall here give the definitions of each, with an enumeration of all the species I possess.

§ 1. *Stamina sterilia in setas graciles apice glanduliferas desinentia; petala margine integerrima.*

P. Caroliniana. *Mich.*—P. palustris. *Lin.*—P. parviflora. *D C., Hook. Fl. Bor. Am.* 1. *t.* 27.—P. Kotzebuei. *Ch. et. Schl.*

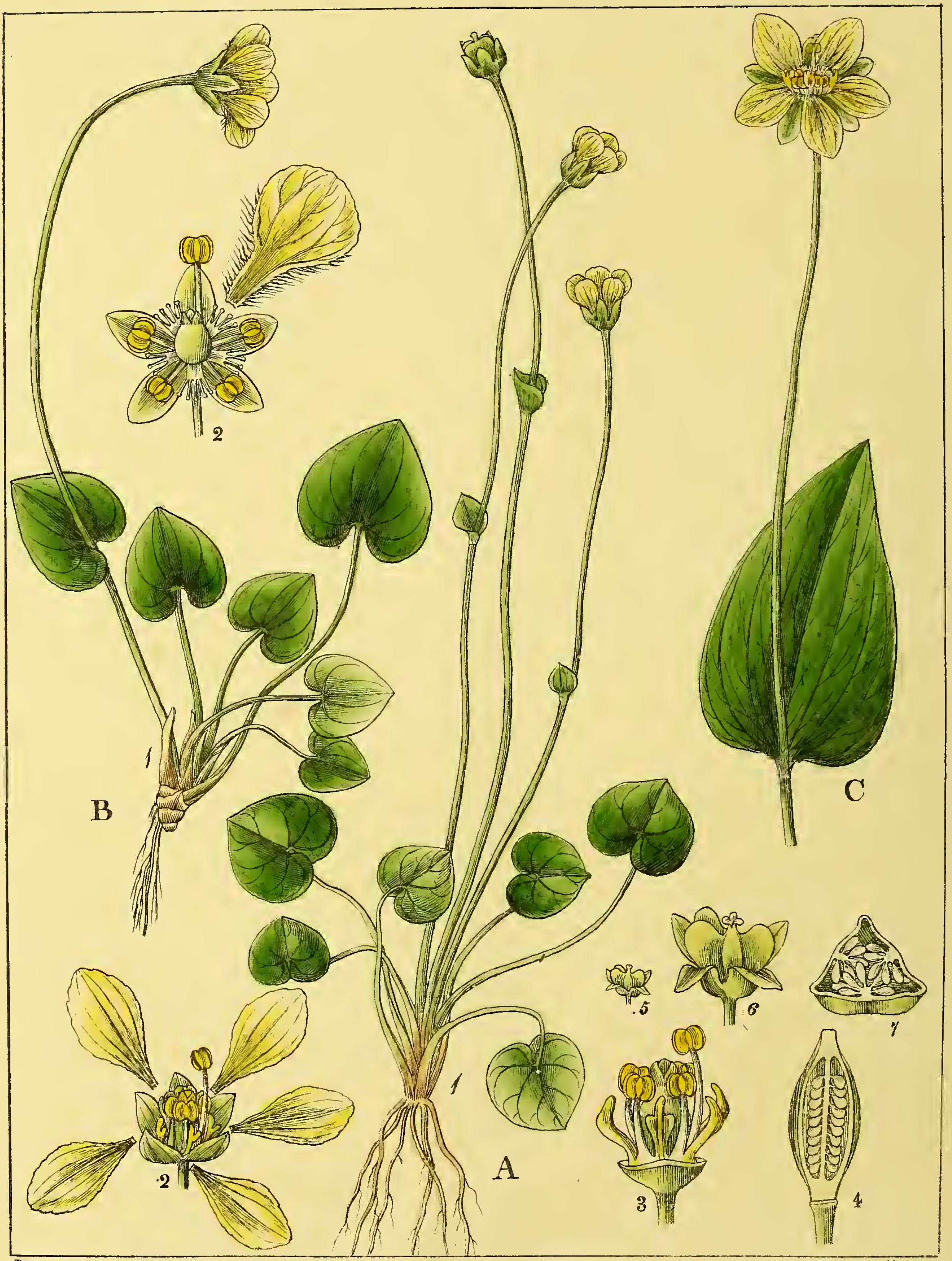
§ 2. *Stamina sterilia in setas validas apice glanduliferas desinentia; petala basin versus fimbriato-lacera.*

1. P. *Wightiana* (Wall.); foliis late cordato-ovatis subreniformibus, sinu subrotundato, bractea foliis simili amplectente, petalis obovato-oblongis margine infra medium in segmenta simplicia vel simpliciter furcata tenuia ciliato-laceris, ungue brevi late cuneato, stamini

Rungia del. Winchester Lith.

A. Drosera Burmanni.

B. D. intermedia. C. D. Indica. D. D. peltata



Rungia del. *Winchester. Lith*

B. P. WIGHTIANA. A. PARNASSIA MYSORNSIS. C. P. NUBICOLA.

bus sterilibus fertilia subæquantibus in setas validas apice glanduliferas desinentibus.—*Wall. Cat. n.* 3755. *Wight et Arn. Prod. Fl. Pen. Ind. Or. p.* 35. *Wight, Cat. n.* 116.

HAB. Mountains in the South of the Peninsula of India. *Wight.*

Scapus subpedalis. Folia 1¼ poll. longa, 1½ fere lata.

2. *P. ornata* (Wall.); foliis late cordato-ovatis sinu angusto, bractea consimili amplectente, petalis obovatis basi in unguem conspicue uninervem late linearem angustatis basin versus ungueque copiose ciliato-laceris, laciniis elongatis capillaceo-pinnatisectis, staminibus sterilibus in setas validas apice glanduliferas desinentibus.—*Wall. Cat. n.* 1247.

HAB. Himalayah. *Blinkworth.*

Scapus pedalis. Folia 1½ poll. longa atque lata. Flores magni.

§ 3. *Stamina sterilia apice breviter sub-5-fida, eglandulosa; petala margine ciliato-lacera.*

P. fimbriata. *Banks.—Hook. Bot. Misc.* 1. *t.* 43.

§ 4. *Stamina sterilia apice brevi trifida eglandulosa; petala margine subintegerrima.*

3. *P. nubicola* (Wall.); foliis elliptico-oblongis 7—9-nerviis basi retusis et subiter in petiolum contractis, nervis subtus prominulis, bractea late ovata vel oblonga basi retusa sessili, petalis oblongis sepala subtriplo superantibus ungue brevi margine leviter dentato, staminibus sterilibus dimidio brevioribus apice trilobis, lobis crassis oblongis obtusis.—*Wall. Cat. n.* 1246.

HAB. Gossain-Than. *Wallich.* Kamaon. *Blinkworth.*

Scapus plusquam pedalis. Folia 2½—4 poll. longa, 1½ lata. In hac atque in speciebus duabus sequentibus tria tantum stigmata vidi. Flores majusculi.

4. *P. Mysorensis* (Heyne); foliis cordatis subreniformibus lobis incumbentibus, bractea cordata amplectente, sepalis late ovalibus pedunculi apice incrassato dimidio longioribus, petalis obovali-oblongis unguiculatis margine integerrimis subdenticulatisve sepala 2½-plo superantibus, staminibus sterilibus fertilibus dimidio brevioribus apice trifidis segmentis oblongis obtusis crassiusculis.—*Heyne in Wall. Cat. n.* 3754. *Wight et Arn. Prod. Fl. Pen. Ind. Or. p.* 35.

HAB. Mysore. *Heyne.*

Scapus 3—3½ pollicaris. Folia 4—5½ lin. longa, 3¾ lata. A *P. Kotzebuei*, cui habitu quodammodo similis, differt petalis calyce longioribus, staminum sterilium forma, bractea sessili, foliorumque forma.

5. *P. pusilla* (Wall.); foliis cordato-ovatis lobis divergentibus, bractea ovata subpetiolata, sepalis late ovalibus pedunculi apicem incrassatam æquantibus, petalis obovatis basi sensim in unguem sepala æquantem attenuatis integerrimis sepala 3—4-plo superantibus, staminibus sterilibus apice breviter trifidis fertilia ac sepala subæquantibus.—*Wall. Cat. n.* 1255.

HAB. Gossain-Than. *Wallich.*

Scapus 2¼—3-pollicaris. Folia 3 lin. tantum longa, 2¼—2½ lata.

EXPLANATION OF PLATES 20 and 21.

20.—DROSERACEÆ.

A. 1. Drosea Burmanni, *natural size*—2. A flower opened, showing the calyx, corolla, stamens and ovary—3. A stamen—4. A portion of the branched stigma, highly magnified; the globular bodies, adherent grains of pollen—5. A grain of pollen more highly magnified, showing its lobed or compound structure—6. The 5-valved capsule, after dehiscence—*all more or less magnified.*

B. 1. Drosera intermedia—*natural size.*

C. 1. Drosera India, *natural size*—2. Flower opened as above—3. Stamens back and front views—4. A stigma much magnified, the globular grains seen on the branched portion adherent grains of pollen—5. Capsule 3-valved—6. A seed showing the reticulated testa—7. Portion of a leaf magnified—*all more or less magnified.*

D. 1. Drosera peltata, *natural size*—2. Flower—3. Stamens anther burst—4. Ovary cut transversely, showing parietal placentation and ramous, style and stigma—5. Under side of a leaf magnified—*all more or less magnified.*

21.—PARNASSIEÆ.

A. 1. Parnassia Mysorensis: a medium sized specimen, *natural size*—2. Flower opened to show all its parts—3. The same sepals and petals removed, showing the stamens, abortive stamens, and ovary—4. Carpel cut vertically, showing the seeds on one placentæ—5. Young fruit, *natural size*—6. The same magnified—7. Ovary cut transversely, showing the parietal placentation.

B. 1. P. Wightiana, *natural size*—2. Flower magnified.

C. P. Nubicola, flower and bractea, *natural size*—From a Himalayan specimen.

XVIII.—POLYGALEÆ.

This order which is very generally distributed over the globe, being found in every quarter of it, and in almost every kind of soil and climate, abounds in species, but is very limited in the number of genera, the latter, standing in the proportion of only about 1 to 19 or 20 of the former, on whole order. Among its species every form of vegetation is found, from the very minute annual scarcely 3 inches high, up to large sized trees. Many of these are milky plants, with round stems, and ex-stipulate, scattered, simple, entire, sessile, leaves, or having the limb attenuated into a short petiol. The flowers, which are sometimes solitary, often racemose, with the pedicels furnished with bractiæ, are hermaphrodite and irregular in their form, often small, and inconspicuous, but showy in some of the Polygalas.

The calyx is composed of 5 sepals, 3 exterior smaller; 2 interior and lateral much longer, and petaloid in appearance, *(the wings)*. The corolla of 5 petals, but generally two of these are not developed, leaving only three, which often adhere at the base ; the anterior one larger than the others and somewhat boat-shaped ; *(the keel)* the other two are alternate with the upper lateral sepals. Sometimes the whole number is complete, and then the two additional petals which are usually smaller, are placed between the keel and lateral petals, or between the anterior, and large lateral sepals, showing that it is the middle pair, or those alternating with the large petaloid sepals or wings, that are in the ordinary state of the flower suppressed. The keel is sometimes entire, and then, usually with a crest, sometimes 3-lobed, and without a crest, whence the crest is supposed to be the altered middle lobe of a 3-lobed keel. The stamens below are usually eight, ascending, combined into a tube adhering to the base of the petals ; sometimes 4 and distinct; when combined the tube is split opposite the upper sepal. Anthers clavate, erect, 1-celled, opening by a terminal pore, rarely, by a longitudinal slit. Disk sometimes large and forming a cup round the base of the ovary. Ovary free, compressed, formed of two united carpels, one anterior, and one posterior, usually 2-celled, with the placentæ in the axis, but occasionally, 1-celled, from the suppression of one of the cells, and still more rarely, 1-celled, as in *Xanthophyllum*, with two opposite parietal placentæ. Ovulus solitary, or very rarely, from 2 to 6 in each cell, style simple curved. Fruit loculicidal, sometimes indehiscent. Seeds with a crustacious outer integument, furnished with a caruncului at the base, or an arillus : albumen, usually copious and fleshy ; sometimes reduced to a thin plate, or wanting as in *Xanthophyllum:* Embryo straight, radical next the hilum, cotyledons usually foliacious. The following further explanation of the nature of the irregularity of the flowers I extract from Dr. Lindley's Natural System of Botany, 2d edition.

" The calyx apparently consists of but three pieces,which are usually green, and like sepals in their common state ; but their real number is 5, the two coloured lateral petal-like bodies, sometimes lying within the apparent sepals, being in reality part of the series of the calyx. The corolla is mostly monopetalous, and, if carefully examined, formed of 3 pieces ; namely, the keel and two petals, all soldered together. We have, therefore, an abortion of two petals, according to the laws of alternation : but this is not all; there is not only an abortion of two petals, but of these two which would, if present, be found right and left of the keel. The monopetalous corolla is, therefore, formed by the cohesion of the two posterior and the one anterior petal of a pentapetalous corolla, of which the two lateral petals are suppressed. The keel has an appendage of an anomalous character, called technically a crest, and often consisting of one or even two rows of fringes or divisions, originating not from the margin but from within it, and sometimes cohering in a common membrane at their base. Aug. de St. Hilaire has shewn that this crest is nothing more than the deeply-lobed middle segment of a keel, with these lobes in such a state of cohesion that the central lobe is pushed outwards, while the lateral ones cohere by their own margins and with its back. The stamens are only 8, two therefore are suppressed: or in krameria 4, one being suppressed. I may remark, in addition, that the relative position of the fifth sepal and petal respectively, was first indicated by Brown." *Denham* 31.

Affinities. The opinions of Botanists, have always been much divided in regard to the affinities of this order, and the place it ought to occupy in the natural arrangement of plants Jussieu first placed *Polygala* among the *Monopetalous* orders, placing it at the head of his order *Pediculares*, but afterwards saw reason to change its place, and then ranged it among the *Polypetalæ*. DeCandolle considering it more allied to *Violarieae* and *Droseraceae*, placed it after these orders. Bartling has placed it in his class " *Rhoeadeae*" along with *Residaceæ*, *Fumariaceae*, *Papaveraceae*, *Cruciferae*, and *Capparideae*. Lindley prefers placing it in his alliance " *Acerales*" along with *Aceraceae* (Sycamore's) *Sapendaceae*, (soap-nuts) and *Œsculaceæ*, (horse chesnuts). The following exposition of the affinities of this order, is extracted from his work.

" *Polygalaceæ* are stationed by DeCandolle between *Droseraceæ* and *Tremandraceæ*, and in the immediate vicinity of *Violaceæ*. With the latter they are related on account of their hypogynous stamens, irregular flowers, and cucullate stigma; and with *Tremandraceæ*

on account of the caruncula of their seed. To *Fumarieæ* they approach in the general aspect of their flowers ; but if my theory of the structure of that order be admitted, their resemblance would not be so great as it appears to be. *Leguminosæ* are, notwithstanding their perigynous stamens, an order with which *Polygalaceæ* have great affinity : the irregularity of corolla is of a similar nature in both ; there is in *Leguminosæ* a tendency to suppress the upper lateral petals in *Erythrina*, as in *Polygala ;* the ascending direction of the style and a cohesion of stamens are characters common to both orders. Many additional observations are made by St. Hilaire and Moquin—Tandon to the same effect. These authors, moreover, compare this order with *Rutaceæ ;* but they appear to have finally decided upon the vicinity of *Sapindaceæ* being its true position ; remarking that " the calyx of *Sapindaceæ* is unequal the corolla very irregular, and the ovary of *Schmidelia* is usually 2-celled and 2-seeded like that of *Polygala.* Moreover, the greater part of the genera of that order have, with a calyx of five divisions, a corolla with four petals, and the place of the fifth is manifestly vacant. This suppression is not exactly the same as what is observed in the corolla of *Polygala,* where there is only 3 petals with 5 sepals ; but the suppression has more analogy with what concerns the stamens, since with a quinary number in the calyx each order has eight antheriferous filaments."

Geographical Distribution. As already observed, this is most general, every part of the world being able to boast of some species, peculiarly its own. The genus *Polygala* is found in all climates, from the equinox to the polar circles, and in every variety of soil, from the burning sands and plains of Coromandel, to the Peat bogs of the northern mountains, and no where met with in greater beauty, than on the dry chalk hills of Kent. The other genera are more limited in their range. *Salomonia* has as yet only been met with in Asia, but extends from China to the Malabar Coast, being more or less met with in all the intermediate countries. *Soulamia* is as yet only known to exist in the Moluccas *Xanthophyllum* has a range nearly as wide as *Salomonia,* extending from Java, (whence Blume has three species which he had published under the generic name of *Jackia*) through Silhet, Ceylon, and Coromandel, to Malabar, but has not yet been met with out of Asia. Most of the other genera are American, but *Muraltia* is confined to the Cape of Good Hope.

Properties and Uses. Were the properties of the species of *Polygala* in accordance with virtues expressed in the name, (*Poly gala* ' Much milk,' in allusion to their supposed power of augmenting the flow of that secretion) truly valuable would they be in many situations, but we have no proof of their possessing such powers. Generally speaking, bitterness, combined in a greater or less degree with cathartic properties, have been found in those species which have been subjected to trial, especially *Polygala amara,* on which account, it is esteemed in chronic bowel complaints after active inflammatory symptoms have subsided. But the diseases for the cure of which they have attained their greatest repute, are those of the chest, requiring expectorants, on account of their action on the mucous membrane of the bronchi. In such cases, if inflammatory symptoms exist, they must in the first instance be reduced by bleeding. The *senega,* or snake-root of America, (*Polygala senega*) is the species which has attained the highest repute for its medical properties, and especially as a remedy in diseases of the chest, but notwithstanding it has been highly extolled in such cases, and no doubt in many instances deservedly, there is still much uncertainty as to its real merits. Among the aborigines of America, it is administered in cases of snake bite, and it was from observing its effects in relieving oppression of breathing in such cases, that analogy led Dr. Tennant to recommend its employment in deseases of the chest. A species met with on the Himalaya mountains *P. crotalarioides* is used by the inhabitants of these hills as a remedy in snake bite in like manner as *P. senega,* is by the Americans. Such being the case, it appears somewhat remarkable, that of all the long list of Indian species, about 20 in number, that not one of them, with that exception, is mentioned as being employed in native practice, and yet, I cannot help thinking, that some at least of the Indian species, enjoy properties analogous to those found in both the European and American ones.

A peculiar vegetable principle, called *Senegen* has been discovered by one chemist, (Gehlen) and a different one by another, (Reschier) which he has called *Polygaline,* but it is still uncertain whether they are not the same. A third (M. Folchi) has procured a sub-

stance, which he calls *Polygaline,* under the form of brilliant pale coloured scales, at first insipid, afterwards acrid and burning to the taste, insoluble in distilled water, and but sparingly soluble in alcohol. M. Dulong on the contrary, procured one, deliquescent and very soluble in water and alcohol. M. Peschier states that he obtained from 6 ounces of the root 100 grains of an alcaline substance, united with a new acid, which he has called *acide Polygalinique.* The *Krameria* or *Ratany* root remarkable for its astringent, properties and for its extensive employment by preparers of Port wine in Britian, is derived from another genus of this or a nearly allied family. The species of *Xanthophyllum* are trees that furnish timber of considerable size, and being besides handsome flowering plants, deserve a place in the garden, as does *Polygala arillata* a very handsome flowering shrub, not uncommon on the higher hills of this country. The properties of both *Xanthophyllum* and *P. arillata* if they possess any, are unknown. It seems to me desirable to remove the latter from the genus *Polygala,* from most of the species of which it differs very widely in habit and in the arillus which covers the whole of the seed.

Remarks on Genera and Species. Three genera only, of this order, have as yet been found in the Indian Peninsula, viz. *Polygala, Xanthophyllum,* and *Salomonia.* The first of these, is a very old genus, has been long known as a native of India, but of which it appears Dr. Roxburgh knew only 2 peninsular species, these have now been increased to 14, and Dr. Wallich and Mr. Royle mention several others, not met with in this part of India. *Xanthophyllum* is a genus originally established by Roxburgh for two Silhet trees, but is now found to extend nearly to the southern extremity of the peninsula, as I have several species from Courtallum, and one from Ceylon. It is also found in Java, whence Blume has 3 species to which he has given the name of *Jackia,* not knowing, that the genus had been previously named by Roxburgh. The genus *Salomonia,* originally established by Loureiro to receive a small Chinese plant, has recently had considerable additions made to it. Two have been found in Nepaul, three in Ceylon, and one in Malabar. The last, having been discovered for the first time in 1835, the genus has not yet found its way into our catalogue of peninsular plants, on which account I have availed myself of the present opportunity of making it known. The species of *Polygala* here represented, was selected on account of its being new to the peninsular flora, and under the supposition that it is a new species. On this last point however I have still some doubts, not but that my plant appears more distinct from *P. persecariæfolia* as figured by Wallich (Plant. rar. tab. 184) than many of the other allied species of the genus which are kept distinct, but because, I find they have a strong tendency to vary in their forms. I was particularly struck with this disposition while examining a very large series of specimens of *P. Javana,* presenting almost every form of vegetation and outline of foliage, but all agreeing in two points, the large wings of the calyx, and in having a curious 2 lobed membranous appendage, or arillus pendant from the carunculus. In like manner *P. Heyneana* has three, smaller, but in other respects similar, appendages hanging like flaps, nearly the whole length of the seed, from its carunculus, by which a number of sufficiently distinct looking specimens were with certainty associated. None of the other species possessed an equally certain guide by which to bring varying forms together, but from what I have observed in these two, I feel but little hesitation in concluding, that in some instances mere varieties are raised to the rank of species.

The genus *Salomonia* is distinguished from *Polygala* by the absence of the large wing-like interior sepals ; its 5 sepals being all nearly equal, by having four, not eight, stamens with the filaments united their whole length ; and lastly, by the capsule being furnished on the margine with long tooth-like bristles, in place of being naked, or ciliated. Two species are introduced into the accompanying plate, one from Ceylon, recently discovered, and the other from Malabar.

The genus *Xanthophyllum* differs from the rest of the order in having symmetrical flowers, except the stamens, and exalbuminous seed. Here in place of three petals firmly united at the base into one, there are 5 petals, corresponding in number, and alternate with the lobes of the calyx, but the stamens retain the unsymmetrical character of the order. It differs further from the character of the order in having the placentæ parietal in place of in the axis of the ovary. The species of *Xanthophyllum* here figured I at first doubted, whether to consider a narrow-leaved variety of one of Roxburgh's species, or distinct from both ; the latter I now think the more correct view ; partly on account of the difference of appearance of this plant, but much more

on account of the difference of structure which its ovary presents. In *X. flavescens*, Roxburgh describes and figures the ovary as having two tubercles rising from the base, each bearing two erect ovules, and in his *X. virens*, he represents the placentæ as forming two projections, one from each side of the ovary extending its whole length, and each bearing from 4 to 6 ovules. In my plant, I find only 4 ovules, as in *flavescens*, but differently situated, one namely from each extremity of each placenta, one ascending the other pendulous. On this account it approaches more nearly to *X. virens*, but in that species each placenta bears from 4 to 6 ovules in two rows. I may here observe that in our Prodromus we have fallen into an error in adopting the name *flavescens*, for the only species it contains. It is most true that in its general aspect, our plant corresponds with Roxburgh's *flavescens*, even to the colour of the leaves, but it differs in the structure of the ovary, the principal point of difference between Roxburgh's two species. From *X. virens*, both the present species and *flavescens* of the Prodromus differ in the absence of a glandular enlargement of the veins on the lower surface of the leaves, and in changing to yellow in drying. The very distant stations of the two plants, tend, still further, to confirm the opinion that they are distinct. On this point however, I refrain from offering any decided opinion, as I have not seen a specimen of the original *X. virens*. Among my specimens from Courtallum and Ceylon, there are five distinct forms, which may be thus distinguished and named—1st, the one here figured, *X. angustifolium*. 2d, one with subsecund spicate racemes, elliptic, shortly acuminated, green, leaves; ovary with four ovules, 2 erect and 2 pendulous, *X. Roxburgianum*. 3d, one with hard coriacious reticulated, glabrous, acuminated leaves, undulated on the margin; ovary with four transverse ovules, *X. undulatum*. 4th, the form described in our Prodromus under the name of *X. flavescens*, but which I now consider quite distinct from Roxburgh's plant, *X. Arnottianum:* and lastly, one from Ceylon, with oval leaves, ending in an abrupt, rather long pointed, acumen; the ovary 4-ovuled, the ovules attached to the base, ascending; probably the true *X. flavescens* of Roxb: the figure of which it greatly resembles.

POLYGALA.

P. Wallichiana. (R. W.) Glabrous, erect, ramous: leaves narrow, lanceolate, obtuse: racemes axillary, or from the forks of the branches, many flowered: wings from broadly ovate to orbicular, longer than the capsules: capsule margined, glabrous: seeds black, densely covered with white hairs, caruncului white edentulate.

P. persicariaefolia. Wall. List 4185, c.

A native of Alpine districts, frequent on the Pulney hills, where the plant attains a much larger size than the one here represented, bearing fewer but longer racemes.

This differs from the plant figured by Wallich, in being perfectly glabrous, diffusely, ramous in having the racemes invariably springing from the branches, in place of terminal as in his plant, sometimes they are axillary, sometimes supra-axillary, and not unfrequently from the forks of the branches. The flowers appear much smaller than in his. It differs from DeCandolle's plant in being glabrous, not pubescent, and in having glabrous, not ciliate capsules. From Dons, *P. Buchanani*, it differs in its ramous habit, and in being every where glabrous. The plant here figured is, I find, equally a native of the Himalayas, and of the southern mountains, as I have a specimen from Simla, procured from a very extensive and beautifully preserved collection of plants formed, while there, by Lady Dalhousie.

SALOMONIA.

Calyx 5-sepaled, sepals about equal. Petals 3, united below into a tube, cleft longitudinally on one side. Stamens 4, filaments united their whole length, and adhering near the base to the tube of the corolla. Anthers 4. Capsule compressed, bristle-toothed on the margin, 2-lobed, 2-celled, with a single pendulous seed in each cell. Seed compressed, glabrous, sub-lenticular black, testa crustacious, brittle. Embryo large, straight, enclosed in albumen. Cotyledons foliacious, radicle pointing to the hilum.

Small herbaceous plants; leaves alternate; racemes terminal; flowers minute, purplish, each furnished with a bractea.

Mr. Don characterizes this genus as exalbuminous, and with an inverse embryo, in both of which points, it appears to me he is mistaken; the albumen being rather copious in *S. obovata*, and the embryo erect with respect to the seed, though inverse with reference to the plant.

1. *S. obovata.* (R. W.) Erect, ramous: leaves sub-sessile, glabrous, obovate obtuse, or spathulate below; above, from sub-orbicular to cordate: spikes elongated: capsules bristle-toothed on the margine.

Malabar Coast and Ceylon.

My specimens from Malabar scarcely exceed three inches in height, but are very ramous, some that I have from Ceylon of apparently the same plant, are much larger, but less branched; in all other respects they correspond. Perhaps the species is too nearly allied to *S. oblongifolia* D.C. which however seems distinct.

2. *Salomonia cordata.* (Arnott) Ramous, leaves sessile, cordate, ovate, glabrous on the sides, ciliate on the margin; spikes elongated: capsules crestato-pectinate. Arnott.

Sea Coast Ceylon.

All the species from southern India are coast plants. Mr. Arnott inadvertently quotes the mountains of

Ceylon as the station of the two species seen by him, but I am informed by Colonel Walker, who communicated the specimens, that that is an error, as he got them both in the neighbourhood of Colombo.

XANTHOPHYLLUM. (Roxb.)

1. *X. angustifolium.* (R. W.) Leaves narrow lanceolate, obtuse, glabrous, longer than the axillary and terminal racemes: ovary 1-celled, 4-ovuled, two ascending from the base, and two pendulous from the apix of the cell: Fruit.

Courtallum in thickets. The leaves of this species which are hard and coriacious do not turn yellow in drying but are of a pale brownish colour.

2. *X. undulatum.* (R. W.) Leaves elliptic, oblong, acuminated, undulated on the margin, coriacious: Ovary 1-celled, 4-ovuled, ovules transverse.

Courtallum. This species agrees so much in the texture and colour of the leaves as well as in the character of the ovary, with the preceding that I rather doubt the propriety of separating them, but the undulated margin, the long pointed acumen, and the much larger size, in all its parts, of the one than the other, fully warrant me, I think in doing so.

3. *X. Roxburgianum.* (R. W.) Leaves broadly elliptical, acuminated: racemes axillary and terminal, shorter than the leaves, subsecund: Ovary 1-celled, 4-ovuled, two ascending, and two pendulous; Fruit.

Courtallum and Shevagerry hills in woods and thickets.

This species which differs very widely from the preceding in appearance, seems, judging from the specimens alone, to be a diffuse or scandent shrub. The leaves retain their green colour in drying.

4. *X. Arnottianum.* (R. W.) leaves elliptic oblong, with a short blunt acumination: under side with two pores at the base: racemes axillary and terminal: Ovules 8—12; attached by pairs to two lateral placentæ: fruit globose, one seeded.

X. flavescens W. and A. *Prod. not Roxburgh.*

Woods about Courtallum and elsewhere.

5. *X. flavescens?* Roxb. Leaves elliptic oblong, with a longish fine pointed acumination; numerous dores scattered over the under surface: racemes axillary and terminal, shorter than the leaves: Ovules 4, erect, attached near the base of the ovary. *Ceylon —Communicated by Colonel Walker.*

This is a handsome species, and is perhaps distinct from Roxburgh's flavescens though corresponding with it, in the character of the ovary and ovules; but while unacquainted with the original species, I feel averse to add to the difficulties of a sufficiently difficult genus, by adding doubtful species. The pores on the under surface of the leaves are peculiar, from the circumstance of their being scattered all over them and not as usual confined to the base.

EXPLANATION OF PLATES 22 and 23.

22.—POLYGALA.

A. 1. P. Wallichiana—*natural size.* 2. Flower opened, showing the calyx and corolla. 3. The same, the corolla drawn back to shew the stamens, ovary and style. 4. A stamen. 5. Style and stigma. 6. Capsule. 7. The same split vertically, showing the seeds *in situ.* 8. Seed. 9. Embryo. 10. Seed of *Polygala Heyneana,* showing the pendulous lobes of the carunculus. 11, 12. Back and front views of *P. Javana,* showing the two large lobes of its carunculus—*all more or less magnified.*

B. 1. Salomonia obovata---*natural size.* 2. Calyx and corolla. 3. The same, the petals and stamens separated, showing the ovary, style and stigma. 4. Capsule. 5. The same opened, showing the seed. 6. A seed---*all more or less magnified.*

C. 1. Salomonia cordata---*natural size.* 2. A leaf magnified. 3. Flower opened, and the petals and stamens removed to show the ovary, style and stigma. 4. Capsule. 5. Capsule opened. 6. Seed. 7. The same cut transversely. 8. Embryo removed---*all more or less magnified.*

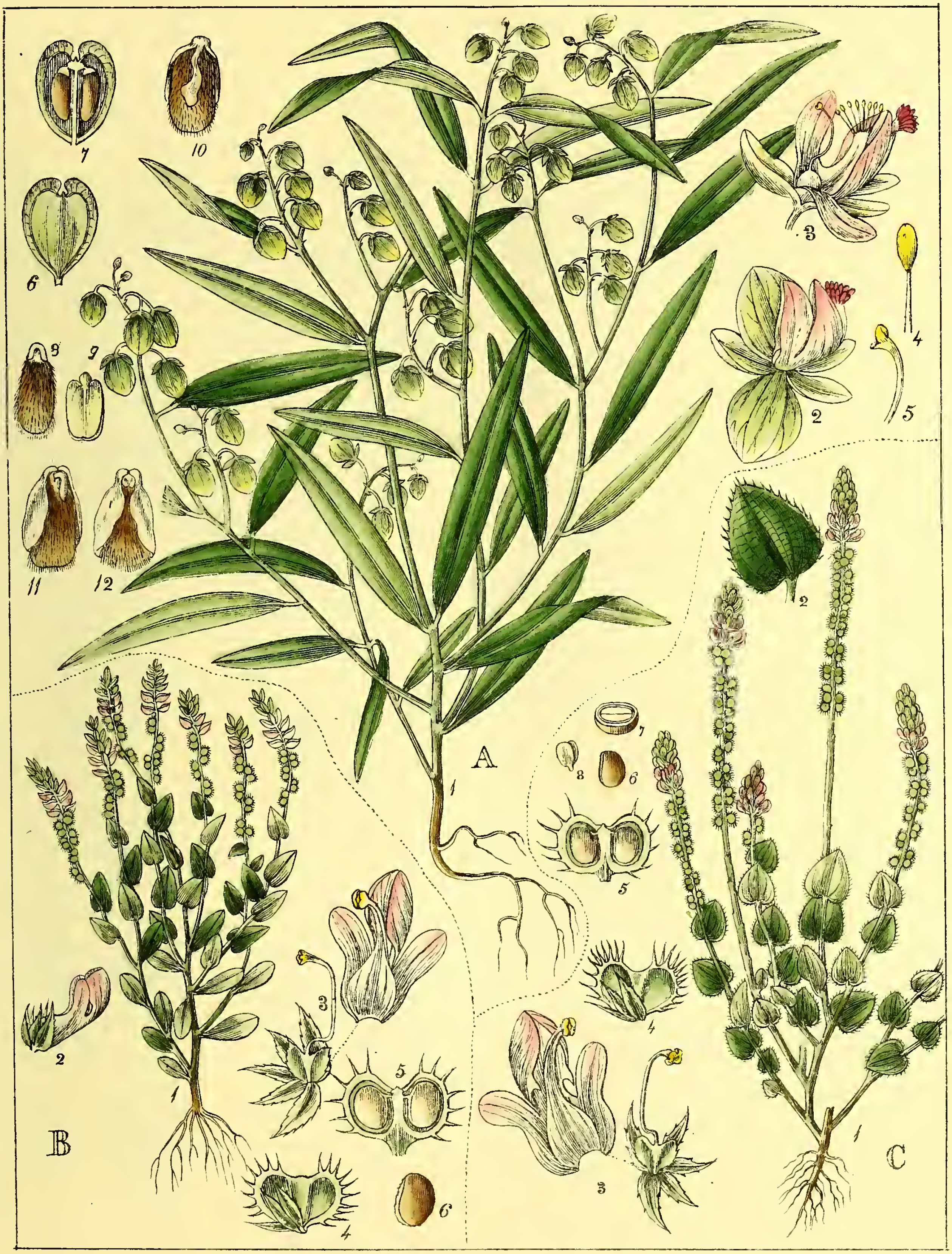
23.---XANTHOPHYLLUM.

1. *X.* angustifolium---*natural size.* 2. Flower. 3. Petals removed, showing the stamens. 4. Stamen separated. 5. Ovary. 6. Ovary opened, showing the position of the ovules---*all more or less magnified.* 7. Young fruit---*natural size.* 8. The same opened showing that all the ovules but one have aborted *magnified.* 9. Ovary of *X. Arnottianum* laid open, showing one placenta with its attached ovules. 10. Ovary of *X. flavescens?* showing the four erect ovules---*both magnified.*

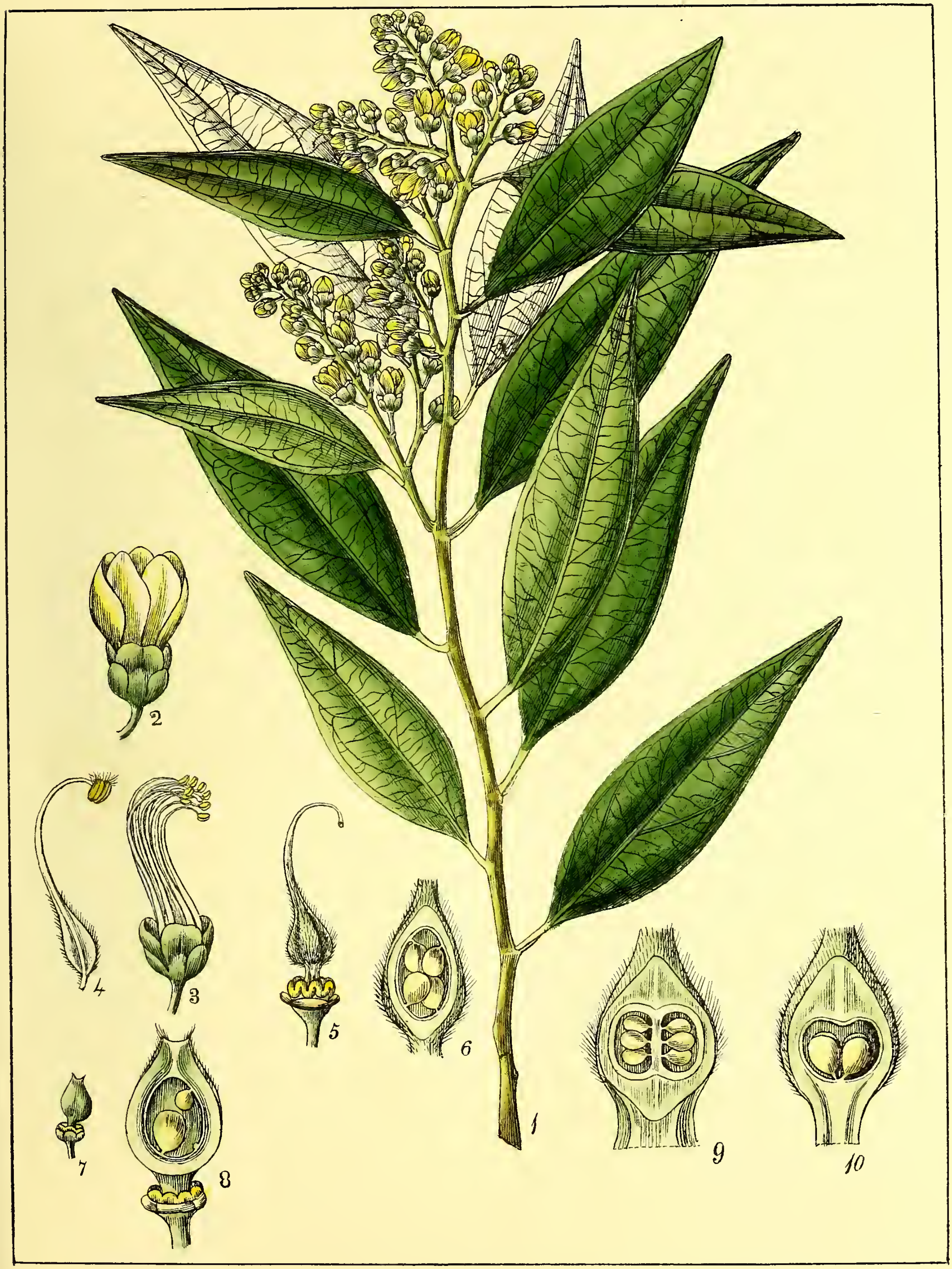
XIX.—TAMARISCINEÆ.

This is a small order, composed of very ramous shrubs, or small trees; with ex-stipulate, scattered, simple, entire, sessile, minute leaves; sometimes, in Tamarix, scale-like, closely embracing the stem, and lapping over each other, like tiles (imbricating.) The flowers are regular, hermaphrodite, generally ranged in terminal racemes or spikes; pedicels furnished with a small bractea.

The calyx is free or slightly adherent at the base, persistent, of 5 sepals, imbricated in œstivation. The torus is either obsolete, or expanded into a small disk, glanduliferous on the margin. The petals equal the number of the sepals, and are alternate with them, inferior, sometimes adherent at the base, and marcescent, or withering without falling off. The stamens are hypogynous, equalling, or double, the number of the petals, rarely, by abortion, fewer than in this proportion, (this I have observed in *Trichaurus ericoides,*) occasionally monadelphous at the base; the anthers 2-celled, opening longitudinally. The ovary is sessile, 1-celled, usually



A. POLYGALA WALLICHIANA. R.W.
B. SALOMONIA OBOVATA. (R.W.) C. SALOMONIA CORDATA. ARN.



XANTHOPHYLLUM ANGUSTIFOLUM. (R.W.)

with three, many-ovuled, placentæ, either attached to the base, or extending some distance along the valves; in the latter case they are occasionally dilated, so as to form a 3-celled fruit. Stigmas usually three, either sessile or supported on a style, simple, dilated, or plumose. Capsule 3-valved, 1-celled, seed numerous, oblong, beaked, with a tuft of down at the apex, sometimes villous all over. Albumen wanting, or according to Bartling sometimes present, and then thin fleshy or mealy. Embryo straight, the radicle pointing to the hilum.

Affinities. The place that this order should occupy in the natural system has long been a subject of dispute among Botanists, some, among whom Jussieu set the example, placing it among the orders with perigynous stamens, that is, having the filaments inserted into the calyx, in this arrangement he has been followed by DeCandolle and others. More recently a different view of their structure has been taken, and is now generally adopted, according to which, the stamens are considered hypogynous, that is inserted into the torus or receptacle, but the true place of the petals, whether hypogynous or perigynous, seems still doubtful. This transition though in itself of little moment, has the effect of materially altering the place of the order in the linear series of Jussieu's arrangement by transferring it from a class with perigynous to one with hypogynous, stamens. This part of the natural method being constructed on artificial principles, that is, simply according to the insertion of the stamens, whether into the torus or into the calyx, (a distinction in such cases as the present more easily made upon paper than found in nature) has the effect of occasionally widely separating orders in other respects very nearly allied. By assigning a perigynous in place of a hypogynous, insertion to the stamens of *Tamariscineæ* would have the effect of bringing them among a different set of orders: and in place of standing between *Polygaleæ* and *Elatineæ* in the Peninsular flora, as they now do, they should, on the supposition of the stamens being perigynous, have been placed near *Paronychiaceæ* and *Portulaceæ*. Dr. Lindley, sensible that associations based on niceties of structure so little appreciable by the senses as that upon which these classes are made to rest are almost useless in practice, has availed himself of habit and some other peculiarities of structure to assist in fixing their proper place in the vegetable system, and owing to the similarity of foliation, considers it more advisable to keep this order "near *Illecebreæ*, with which it accords in its unilocular syncarpous often 3-valved fruit, and scale-like leaves." Amidst these conflicting views I confess, though comparatively slightly acquainted with the natural system, I prefer leaving it in its present place, not on account of its hypogynous stamens and petals, since these seem not so easily made out, but on account of its parietal placentation, loculicidal dehiscence, and exalbuminous seed (in which respect it quite accords with the orders between which it is placed) these points of structure, affording marks of distinction most easily made out under all circumstances, and not liable to be mistaken in any. According to this view, the order would have been better placed, it appears to me in Dr. Lindley's 3 group (*Parietosæ*) of *Polypetalæ*, in his "Alliances of plants" than in the one (*Syncarposae*) in which it now stands.

Essential Character. Polypetalous: stamens fewer than 20: ovary wholly superior; carpels of the ovary combined into a solid pistil: sepals imbricated, more than 2: stamens hypogynous: seeds comose (furnished with a tuft of down) leaves without stipules.

Geographical Distribution. The few species of this order are exclusively confined to the northern hemisphere of the old world, but are widely distributed over it. Their most frequent station is on the sea coast and on the banks of rivers. In India they seem to prefer banks in the sandy beds of streams, which are dry the greater part of the year, in such situations I have repeatedly found them. They seem however to have met with but little attention among the natives of this part of the country as I have not been able to discover any Tamul name for them.

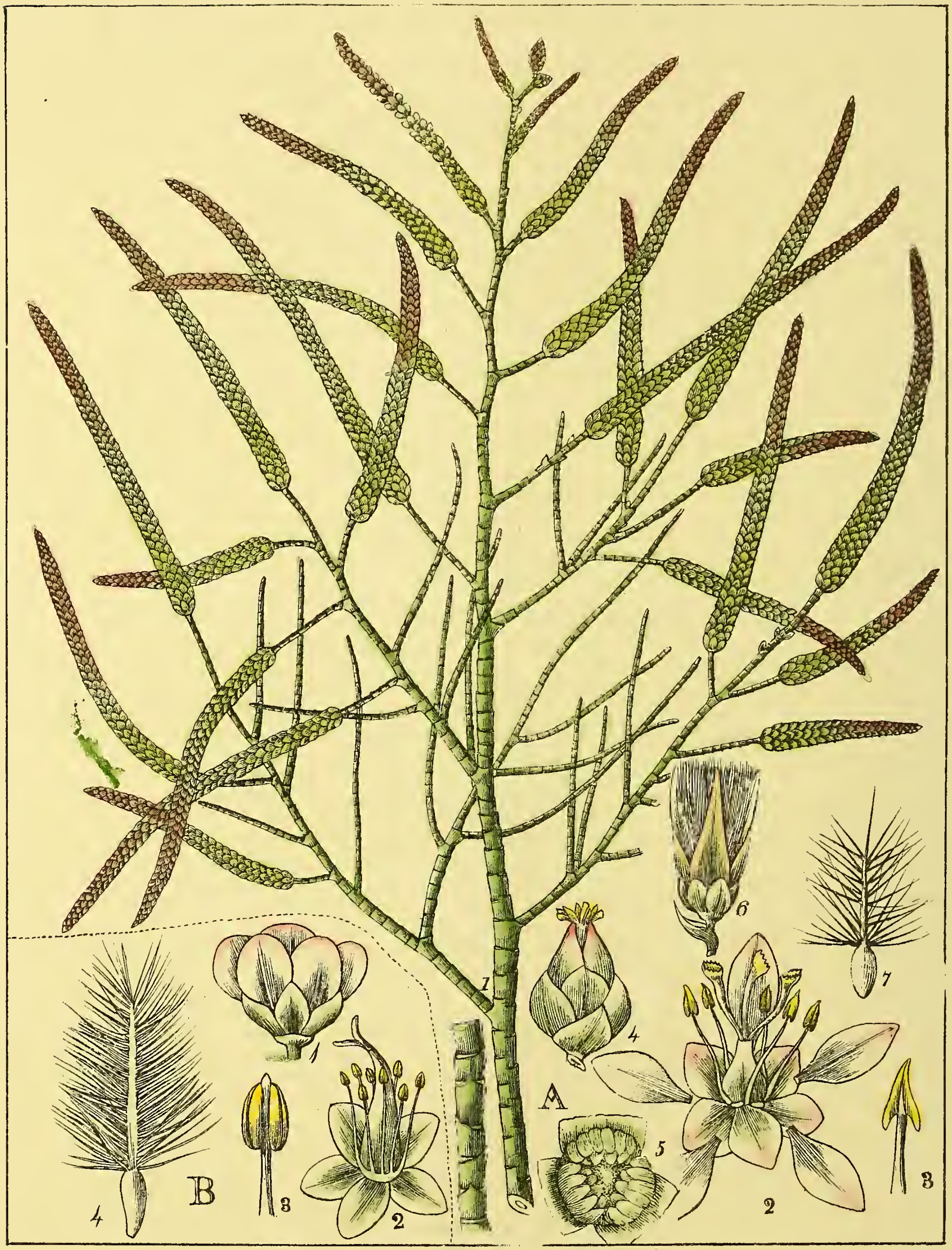
Properties and Uses. The bark of some of the species is slightly bitter and astringent, and probably tonic. Rhazes assigns to it diuretic, aperient, and cooling properties. In Denmark the branches are used in place of yeast for making beer, and the decoction of the leaves and young shoots is prescribed as a substitute for guaiac. The ashes of *Tamarix gallica* and *Africana* growing near the sea are remarkable for containing a quantity of *sulphate of soda!*

and cannot be used as a ley for washing, as they coagulate the soap, while those growing in sweet soil in the interior are free from it. From a species or possibly a variety of *T. Gallica,* which grows about Mount Sinai, there exudes a kind of manna, (from the punctures of an insect which perforates its bark) which has received the name of " Manna of Mount Sinai," and has by some travellers, fancifully enough been supposed the Manna of the Scriptures. Some of the species produce abundance of galls. In Egypt the *Tamarix Orientalis* produces them of a deep red colour, and are much used in dyeing. All the species of this country are said by Mr. Royle to produce galls, having the properties of oak galls, but I have not been able to discover whether they are ever gathered in this part of India. It seems probable from an observation of Mr. Royle, that the galls imported into India from Mooltan, are chiefly of the *Tamarix,* not *Oak galls,* and that it is with them our bazars are principally supplied, on which account we would do well to examine the tamarix jungles, which often extend along the beds of our rivers for miles together, to ascertain to what extent they could supply our wants.

Remarks on Genera and Species. Three of the four genera referred to this order are found in India, the fourth, *(Bronnia)* which seems but a doubtful member, is from America. It has been referred by Kunth to *Portulaceæ,* but is placed in this order by Dr. Lindley. The genus *Trichaurus* is certainly very nearly allied to *Tamarix,* but sufficiently distinguished by its decandrous flowers, its cup-shaped torus bearing the stamens on its margin, and by the different form of the styles and stigmas. The beak of the seeds, which seems to form so excellent a distinguishing mark between it and *Tamarix,* appears to differ rather in degree than in kind, when examined under a high magnifier, since both show the beak, but in *Trichaurus* it is very conspicuous under the most ordinary magnifier, and even to the naked eye, while the other requires one of high powers to bring it out as represented in the figure. The dissected flower of *Trichaurus* is not perhaps the most suitable that might have been selected, since it seems evidently defective, in so far as having only 8 in place of 10 stamens, which last in the absence of positive evidence to the contrary, must on account of the pentasepalous calyx and 5-petaled corolla, be looked upon as the normal number. But that this is merely an irregularity, perhaps of a single flower, is rendered further probable by the circumstance of there being only 2 in place of 3 styles, three being the normal number of the order.

This figure as exhibiting a departure from the usual and regular form is not without its use, since it explains the cause of one of the greatest obstacles to the perfecting of the Linnean sexual system, depending as it does on a single set of organs, the tendency namely, of different flowers, even on the same stalk, to vary in the number of stamens and pistils, and thereby, to indicate very different places in the system for the plant to which they may belong. When our distinctive marks are taken from the relative position and number of all the different parts of the flower to each other, the formation of the ovary, and position of the ovules, added to the general habit of the plants, we have so many points of comparison, that the chances of our being misled through variations or imperfections in any one set of organs, are greatly diminished. Doubtless sufficient uncertainties still exist in the natural method to lead different Botanists to form different opinions both as to the situation orders ought to occupy in the series, and sometimes, in nearly allied orders as to the genera that should be respectively referred to them; but yet, in spite of these drawbacks, its advantages over any artificial arrangement, and the Linnean is certainly the best, are such, as to ensure its general adoption by all who would study botany as a science, and not as a mere means of discovering the name of a plant, as he would the meaning of a word in a dictionary. But even this, in tropical botany, is often a very difficult operation when attempted with no other assistance than that afforded by the Sexual System, because among tropical plants, the sexual organs are so very liable to vary in number from unions among themselves, or from suppressions and additions of parts, giving rise to innumerable instances of irregular forms, among plants usually ranged in classes with regular flowers: even the Papaw, one of the most constant of dioecious plants; I have seen with regular bi-sexual flowers.

But to return from this digression, it appears that the genus *Trichaurus* is amply distinguished from *Tamarix* by having double the number of stamens that it has sepals, and by having the filaments attached to a distinct hypogynous disk, independent of the more distinct beak of the seeds.



A. TAMARIX GALLICA. B. TRICHAURUS ERICOIDES.

The only species of the genus is, I believe, abundant on the dry banks in the bed of the Palar river below Wallajabad.

EXPLANATION OF PLATE 24.

A. 1. Tamarix gallica *var* Indica. *Natural size.* 2. Flower opened, showing the imbricated sepals, the petals, stamens, superior ovary, styles, and dilated stigmas. 3. A stamen showing the sagittate form of the anthers. 4. A single flower as it appears on being removed from the branch, the exterior pointed sepal-like leaf in front, the Bractea. 5. Ovary cut transversely, and opened, showing the parietal attachment of the ovules to the base of the carpels. 6. A mature fruit after dehiscence. 7. A seed with its downy tuft. *All more or less magnified.*

B. 1. Flower of Trichaurus ericoides. 2. Sepals opened, and the petals removed, to show the insertion of the stamens and ovary. 3. A stamen, anther pointed. 4. A seed with its beak. *All magnified.*

XX.—ELATINEÆ.

A small and unimportant order of herbaceous, marsh, plants, found in all the four quarters of the globe. The stems are ramous, the leaves opposite, stipulate, the flowers small, usually aggregated in the axis, hermaphrodite.

Calyx of from 3 to 5 sepals. Petals as many alternate with them. Stamens either equalling the petals or twice as many. Ovarium 3, 4, or 5-celled with as many styles and stigmas, placentæ in the axis bearing numerous ovules. Stigmas capitate. Fruit, a capsule, three 5-celled, three 5-valved, dehiscence either septicidal or loculicidal. Seeds numerous. Albumen sparing or wanting. Embryo cylindrical, radicle next the hilum.

Affinities. These do not appear to me by any means clear. Formerly they were referred to *Caryophylleæ,* thence Cambessides removed them as a distinct order, on account of their exalbuminous seed, and capitate stigmas, to which loculicidal dehiscence is added. Both however being alike in that respect, that last character, which by the way is not constant, since I find in at least two species of *Bergia* the dehiscence septicidal and not loculicidal, can be of little or no value ; unless perhaps as one by which we may keep *Bergia* distinct as a genus, from *Elatine.* The exalbuminous seed and capitate stigmas, while they afford very sufficient grounds for separating them from *Caryophyllaceae* which have a copious mealy albumen with the embryo rolled round it, and linear stigmas, associate the *Elatineae* with *Lythrariae,* in which order, Bartling (*Ordines Plantarum*) has placed them. From these however, it appears to me, their distinctly hypogynous stamens, numerous stigmas, and free ovaries sufficiently remove them. Dr. Lindley places them in an alliance distinguished by having " albumen present in the seeds" along with Lineæ, an arrangement, the propriety of which I confess myself unable to perceive, as the albumen in *Elatineæ* is almost if not entirely wanting.

Essential Character. Polypetalous : stamens fewer than 20 : ovary wholly superior ; placentas in the axis ; styles distinct to the base : calyx imbricated ecalyculate : leaves opposite, furnished with stipules.

Geographical Distribution. The plants of this small order are found in moist, marshy grounds in all the four quarters of the globe—*Elatine* and *Bergia* are found in India. *B. verticillata* is common about the banks of water courses and rice fields, while *B. ammannoides* is more commonly seen in moist sandy soil near the banks of rivers, and in rice fields near the sea coast. *Elatine ambigua* I have only found in the moist soil of half dried tanks in the Tanjore district, where it forms large green patches.

Properties and Uses. The properties of this order are unknown, if the species possess any. In England *Elatine* has received the rather questionable name of " water pepper" which seems to indicate the possession of acrid properties, though that seems doubtful as it is no where men-

tioned, and in this country the *Bergia ammannoides* has, in Tamul, received that of Neer-mel-neripoo, or water-fire, a curious coincidence of names in countries so remote.

Remarks on the Genera. Dr. Arnott and myself following Delile, referred the genus *Bergia* to *Elatine* whether judiciously or not may be doubted, now that I find the dehiscence of *Bergia* is septicidal while that of *Elatine*, as appears from the statements of those who have examined it with care, is loculicidal. This distinction combined with the difference of habit, of the two sets of plants, might I think with propriety be employed as a distinction to keep them generically separate, notwithstanding the similarity of their flowers, on which account, I, in this work, retain the old name of *Bergia* for the *Elatine verticellata* and *E. ammanioides* of our Prodromus, to which work however, I refer for the distinguishing characters. The accompanying plate represents a species of each genus.

EXPLANATION OF PLATE 25.

A. 1. Plant of Bergia ammannoides. *Nataral size.* 2. Portion of a branch slightly magnified to show the stipules and aggregated axillary flowers. 3. Flowers opened, showing the sepals, petals, stamens, ovary, and stigmas. 4. Stamens separate, back and front views. 5. Mature fruit. 6. The same after dehiscence, the persistent calyx removed. 7. Capsule cut transversely. 8. A seed. 9. The same cut transversely. *All more or less magnified.*

These figures show the strong tendency that exists in this species, to variation in the number of the parts of the verticels of the flower, 3, 4 and 5 pieces occurring indiscriminately in different flowers, picked from the same stalk.

B. 1. Elatine ambigua. *Natural size.*

2. A plant removed from the soil and slightly magnified, showing its repent habit. 3. Portion of a branch more magnified. 4. Flower opened. 5. Capsule. 6. The same after dehiscence. 7. A seed. *All more or lees magnified.*

XXI.—CARYOPHYLLACEÆ.

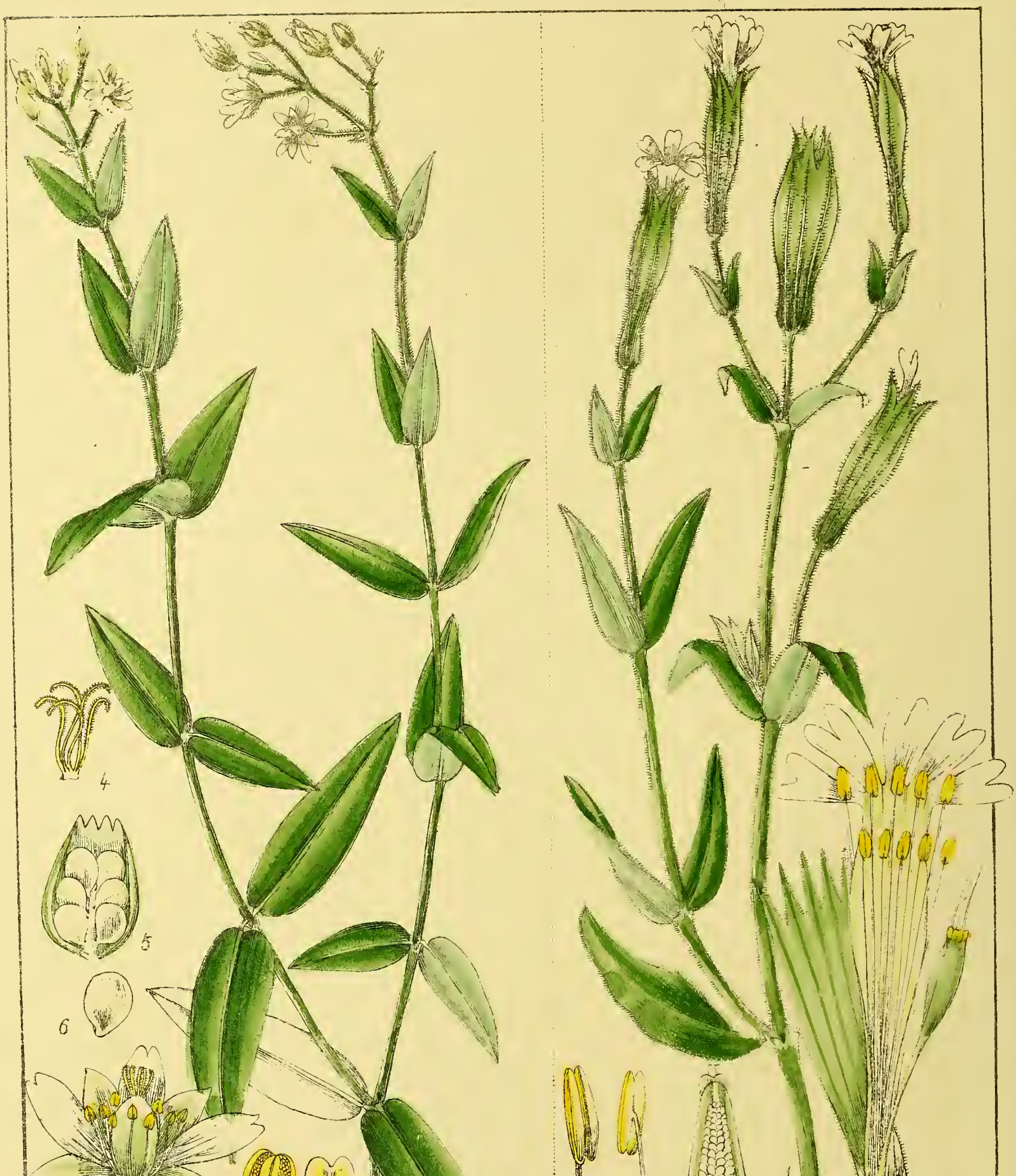
Since the publication of DeCandolle's Prodromus, in which this rather complex order occupies a large space, considerable changes have been made on it by different writers. These principally consist in raising his sub-orders to the rank of distinct orders, the removal of *Elatineae*, and referring some of the genera included by him to other allied, though in the linear series remotely situated, orders. This being for the most part an extra tropical order, these changes so far as they affect the few Indian genera can be easily pointed out without the necessity of changing the name of the order adopted, after DeCandolle, in our Prodromus. Following Dr. Lindley's arrangement, it being the most recent and perhaps the best, the Peninsular genera ranked under *Caryophyllaceæ* by us are thus distributed. *Gypsophila* and *Silene* are referred to *Silenaceae* ; *Stellaria, Cerastium,* and *Arenaria*, to *Alsinaceae:* and *Mollugo* to *Illecebreæ* the *Paronychiaceæ* of our Prodromus. These three orders, along with *Portulaceæ* and *Tamariscineæ* are combined into one " Alliance" *Silenales*, distinguished by having the " Embryo rolled round mealy albumen ; or if this is not the case, herbaceous plants with the joints of the stem tumid, or with scales replacing the leaves upon rod-like branches ; almost all herbaceous, or small shrubs." The clause " with scales replacing the leaves" of this character refers to *Tamariscineae*. The orders are thus summarily distinguished—*Portulaceae* has two sepals : *Silenaceae* four or five united into a tube : *Alsinaceae* four or five distinct : *Tamariscineae* the dehiscence of the fruit loculicidal, seed hairy : and *Illecebreae* have leaves with stipules. In this last the dehiscence is also loculicidal. *Silenaceae* and *Alsinaceae* are represented in the accompanying plate, and *Portulaceae* and *Illecebreae* will be in a subsequent number.

The *Caryophyllaceae*, are distinguished by having a calyx of 4-5 sepals either united or free. Petals four or five, sometimes unguiculate, sometimes wanting. Stamens equal to, or double the number of petals ; when equal alternate with them. A single ovary of 2-5 united carpels either sessile or stipatate, with 2-5 filiform stigmas. Capsule 2-5 valved, one-celled or imperfectly 2-5 celled, the valves usually partially splitting at the apex, forming twice as many

A BERGIA AMMANNOIDES. B ELATINE AMBIGUA

நீரமேலநெருபபு

Nurmale narupoo



CERASTIUM INDICUM

SILENE INTRUSA

teeth as there are valves or stigmas ; placentæ in the axis. Seeds indefinite, albumen mealy, with the embryo curved round it.

This character includes *Silenaceae* and *Alsinaceae*, but excludes *Mollugo*, which has a 3-5 celled capsule, with distinctly loculicidal dehiscence, which, for these reasons, I think more justly referable to *Paronychiaceæ.*

Affinities. These are very various. The curved embryo rolled round a mass of farinacious albumen, intimately connects them with a whole series of orders, all presenting the same peculiarities, but separated in the present artificial disposition of the natural orders, by the structure of the flowers, some having hypogynous, some perigynous stamens, and several being apetalous.

Geographical Distribution. After excluding *Mollugo* this may be considered a strictly extra tropical order, not more than three or four genera, having tropical representatives, and these for the most part confined to the highest hills, or if met with on the plains, only during the cool season. In the temperate zones they are very abundant, and remarkable for presenting in the Pinks and Sweet Williams some of the most beautiful ornaments of the flower garden, and in the Chick weeds its most insignificant weeds.

Properties and Uses. Generally the *Caryophillaceae* may be characterized as uniformly insipid. The petals of the clove jelly flower are employed in medicine, but more on account of their fragrance and the fine colour they impart to infusions, syrups, &c. than for any valuable medicinal properties they possess.

EXPLANATION OF PLATE 26.

1*st.*—1. Cerastium Indicum. *Natural size.*
2. A flower, sepals and petals drawn back to show the stamens, ovary, and styles. Petals cleft at the apex. 3. Stamens back and front view. 4. Styles and stigmas. 5. Capsule cut vertically, showing the contained seeds, and lobed dehiscence of the apex. 6. A seed. *All more or less magnified.*

2*d.*—1. Silene intrusa. *Natural size.*
2. A flower opened showing the tubular calyx, and unguiculate lobed petals, 10 stamens, and stipitate ovary. 3. Anther back and front views. 4. Ovary cut vertically.

XXII.—MALVACEÆ.

A large and important natural order of plants, consisting of trees, shrubs, and herbaceous annuals, with round, spreading branches, alternate, simple, entire, or lobed leaves; generally crenated or toothed; furnished with stipules, and usually clothed with stellate hairs. The flowers are hermaphrodite, or occasionally unisexual, generally regular, solitary or aggregated, in axillary, solitary, or fascicled, peduncles.

The calyx is persistent, composed of 5 sepals, sometimes free, sometimes more or less cohering, valvate (the edges not overlapping) in œstivation, and occasionally as in *Abelmoschus*, splitting only along one side (spathacious) often furnished with an involucrum of approximated bracteæ, resembling an exterior calyx, and so called by Linnæus. The torus is dilated disk-like. The corolla is 5-petaled, inserted into the edge of the torus, alternate with the sepals, equal, unguiculate, cohering at the base among themselves and with the staminal tube, and spirally twisted in œstivation. Stamens usually indefinite, inserted between the petals and ovary; filaments more or less completely united into a tube, sometimes the union, as in *Sida*, is confined to the base, while at others, as *Gossypium*, &c. it extends nearly to the apex, and being of unequal lengths, they present the appearance of a column covered throughout with anthers, with the stigmas projecting and forming the apex of the pillar. The anthers are 1-celled! reniform, opening by a transverse clift, giving passage to the globose hispid! grains of pollen. The ovary is composed of several carpels, either definite (about 5) or indefinite, from 20 to 30 ranged round a central axis, with one or many ovules. Fruit capsular, many

celled, cells either remaining completely united, or becoming more or less distinct, and separating with the seed enclosed, dehiscence in the former case loculicidal. Seeds somewhat reniform attached to the internal angle of the carpels, glabrous or enveloped in a covering of hairs ; albumen none or very sparing. Embryo large, the cotyledons foliacious, variously doubled and twisted, often cordate, radicle pointing to the hilum.

Affinities. This large and, as it may appear from the preceding description, complex order is yet one of easy determination, even among the orders with which it was originally combined by Jussieu, now forming the class *Columniferæ*, of Bartling (all remarkable for having the œstivation of the calyx valvate) by its 1-celled reniform anthers. Dr. Lindley gives the following brief exposition of its affinities, premising as an anomaly in the order that " In *Malope* the carpels are numerous, and distinct, not arranged in a single row as in the rest of the order." " The relation of *Malvaceæ* with *Sterculiaceae*, *Tiliaceae*, and *Elæocarpaceae*, is clearly indicated by their general accordance in structure, and especially by the valvate œstivation of their calyx. With other orders they also agree in numerous points ; as, with *Ranunculaceae*, in the indefinite stamens and distinct aggregate carpels of *Malope ;* with *Ternstrœmiaceae* in their monadelphous stamens ; with *Chlenaceae* in the presence of an involucre below the flower, and monadelphous stamens ; with *Linaceae* in their mucilaginous properties, definite seeds, many-celled fruit, and unguiculate petals ; and through the medium of this last order with *Silenaceæ*."

Essential Character. Polypetalous dicotyledons. Calyx with valrate œstivation. Stamens numerous, monadelphous : *Anthers one-celled.* Ovary wholly superior ; of several carpels combined into a solid pistil, with more placentas than one. Leaves furnished with stipules.

Geographical Distribution. This, although some species extend nearly to the polar limits of the temperate zone, may be looked upon as principally a tropical family, the greater part of them being found either within the tropics, or in the warmer latitudes on their immediate confines and within that range are very abundant both as to species and individuals. Three or four only are found in England, but the number is considerable in the south of Europe, while in the north they altogether disappear. The Indian peninsula presents a catalogue of about 62 or about $\frac{1}{64}$ of the whole phenogamous flora (estimated to amount to 4000 species) which is a considerably smaller proportion than that of the equinoxial regions of America, in which they are said to amount to $\frac{1}{47}$th or $\frac{1}{50}$th of the flowering plants. This difference may possibly result from my having used too high an estimate for the whole flora as according to Brown, the proportion for tropical India is as high as $\frac{1}{34}$: this again may be owing to his having included *Byttneriaceae* and *Bombaceae* in his calculation which I have excluded from mine, but which when included still leaves the proportion below Mr. Brown's ratio. With the addition of these orders, the ratio *malvales* bear to the rest of the flora, estimated as above at 4000, is $\frac{1}{40}$th which I believe may be considered a very near approximation to Mr. Brown's estimate, now that the proportions have been altered, by the recent discovery of many alpine plants altogether unknown to Roxburgh, from whose materials Mr. Brown's estimate is deduced.

Properties and Uses. Mankind are largely beholden to this order, more so perhaps than to any other, as supplying them with food, medicine, shelter and clothing.

The uniform character of *Malvaceae* is to abound in mucilage and to be totally destitute of unwholesome properties. Such being the case, it is to be expected that many of them are employed as food : among these may be enumerated our *Hibiscus* (Abelmoschus) *esculentus* the mucilaginous fruit of which is our well-known Bândikai : *Hibiscus Cannabinus*, the leaves of which are eat as spinach, while the fibres of the bark is twisted into a kind of cordage : the *Hibiscus Subdariffa* or *rozelle* from the fleshy acid calyx of which, excellent jelly, and tart fruit, are prepared : and many others.

In medicine nearly the whole tribe are employed, as affording medicines possessing demulcent, and emollient properties. The marsh mallow, and many other allied species are indiscriminately used as such in Europe, and several species of *Abutilon* (Sida), such as *A. indicum* and *Asiaticum* are similarly employed in this country. The yellow juice, as well as strong infusions of

the bark of *Thespesia* (Hibiscus) *populnea* (Portia tree) are employed by native practitioners for the cure of cutaneous diseases. An infusion of the roots of *Pavonia odorata* is prescribed as a diet-drink in fevers. Other species of this order are, and nearly all from their mucilaginous properties, may be, similarly employed. The petals of *Hibiscus Rosa Sinesis* (Shoe-flower or China-rose) communicate, when rubbed on paper, a bluish purple tint which forms a very excellent substitute for Litmus paper as a chymical test. It has been already remarked that the fibres of the bark of *Hibiscus Cannabinus* are employed in the formation of course cordage, those of most of the larger kinds might be thus used, as in all they are very strong. The heart wood of *Thespesia* (Hibiscus) *populnea* is dark coloured and very hard, somewhat resembling that of the chesnut, and like it, adapted for the formation of gun stocks and similar purposes requiring a hard close grained, but not heavy or large sized, timber, which this rarely becomes, owing to the white outside portion being like that procured from all the other arborious forms occurring in the order, soft and of little value.

This last named species enjoys in a remarkable degree, a peculiar tenacity of life, large branches, after being severed from the trunk, surviving long enough to admit of their taking root, when planted as cuttings, like slender slips, and in a few months presenting the appearance of very respectable sized trees. It is worthy of remark however, that the trees so produced, rarely produce seed though they flower freely, and what is perhaps not less deserving of notice, they all decay in the centre, hence it is now rare among them to meet with either the mature fruit, or a sound timber tree, the practice of thus propagating them by cuttings, in place of by seed, for so long a time, having at length apparently destroyed their reproductive power, and deteriorated the quality of their vegetation.

But it is in their last mentioned capacity, that of affording clothing, that the *Malvaceae* become the greatest benefactors of mankind, Cotton being the produce of a genus of plants appertaining to this order. The genus *Gossypium* from which it is derived, embraces but few species, and these of difficult discrimination, owing to long culture having caused them to run into every variety of form. So great indeed is their tendency to run into variations that some Botanists have even doubted whether there are more than two distinct, and permanently distinguishable species, among the whole host of forms that have by different authors been supposed entitled to rank as such.

To some it may appear a question of little moment whether we consider all these forms as species or varieties so long as they continue permanent. This is partly true, but at the same time it is desirable to ascertain what are species and what varieties, since the term species implies permanency, while variety conveys exactly the opposite idea, or that of liability to change under any variation of the circumstances under which they may be produced, hence their aptitude for culture unchanged in some favoured situations and their disposition to change in others to all appearance equally favourable. My own observations certainly lead me to adopt the conclusion, that the species have been unnecessarily multiplied by some, and reduced too low by others. Thus DeCandolle enumerates 13 species, and Mr. Royle eight, both these catalogues will probably be found in excess. Dr. Lush and Jacquemont reduce them to two. These Botanists probably err in the opposite extreme, but yet, as their opportunities of observation were great, their statements must be received with deference. They seem to attach no value to characters taken either from the colour or quality of the wool on the seed, or the absence or presence of a coating of short hair or down, with which the seed of some sorts are clothed; neither to the forms of the foliage or native country, or clothing, or habit, of the plants, whether glabrous or hairy, arborious or annual. According to this view the various Indian forms in which a somewhat palmate form of the foliage prevails and is most constant, and the American ones figured here under the specific name of *G. barbadense*, in which a lobed and angled foliage is equally permanent are all mere varieties of the same plant, while the form named *G. acuminatum* is, on account of its adherent seed alone, looked upon as a distinct species. With this view I confess I feel disposed to coincide to a great extent, though not to go the whole length, since I cannot yet bring myself to acknowledge the specific identity of the constantly palmated leaved and hispid Indian forms, and the equally permanently lobed and angled leaved and glabrous American forms. The more so, as these forms retain their peculiarities of foliage in all the varied situations and circumstances in which they have been made to grow in all the four quarters of the world. Under this view, I acknowledge three species as cer-

tain, viz. the old *Gossypium herbaceum*, with palmately lobed leaves, whether an annual or a tree of indefinite duration, secondly, the American form with simply lobed or angled leaves, equally leaving duration out of the question, *G. barbadense;* and thirdly, the form with the seed adherent in form of a cone, *G. acuminatum*, comprehending the various forms known under the names of Pernambuco, Peruvian, Bahia and Ava cotton. I prefer Roxburgh's name to the older *G. peruvianum*, as it expresses the prevailing form of the lobes of the leaves rather than the native country of a plant so widely distributed. Under the first of these leading forms may be ranged: *G. indicum Lam: G. micranthum Cav. G. arboreum? Linn. G. vitifolium (?) Lam. G. hirsutum Linn. G. eglandulosum Cav. G. religiosum (?) Linn.* and *G. obtusifolium*, Roxb. Under the second all the American forms with distinct seed*:* and under the third, all those having them coherent; whether downy or smooth, or with 3 or 4-valved capsules. Dr. B. Hamilton, following Van Rohr employs the seed to furnish his specific characters, and according as they are black or white, reduces all the forms to one or other of two species, distinguished by that mark. Our country Cotton, and all its varieties, form his *G. album* : the American ones with black seed, his *G. nigrum*, among which *G. acuminatum* is included. The characters on which this division is established I consider of no value in themselves, but the division itself, excluding *G. acuminatum* from his *G. nigrum*, I think correct.

In three instances in the above enumeration I have added marks of doubt. indicating thereby, that I am still uncertain whether or not they ought to be considered distinct species. Judging from Mr. Royle's description, *G. vitifolium* seems to be either a hybrid or cross, between the Indian and American forms, or *G. acuminatum*, but as I have not examined the plant I forbear to offer any opinion. The other two, *G. arboreum* and *G. religiosum* are, I believe the same plant, though possibly distinct, but I rather think not, since the difference of the colour of the flower only, (the one purple the other yellow), gives probability to that supposition, and such a distinction, would scarcely be admitted in any other genus. With the view however of enabling all those who take an interest in this branch of the enquiry to judge for themselves, I shall copy and reprint in outline, in my forthcoming *Icones*, along with the obtuse lobed variety, Mr. Royle's figures, both as showing the grounds on which his opinion is formed, and the difference of forms of the Asiatic and American species. In so far as I have yet gone, my remarks have all been directed to the botanical peculiarities of this genus, it is now incumbent on me, in a work which has for its object to give some account of the history and the uses of the more valuable plants which fall to be noticed in its progress, to consider briefly the economical applications of the produce of this genus, which, when viewed in all its relations, must without any exception, be ranked as the most valuable to mankind of the whole vegetable kingdom.

During the year 1835, there was imported into England 361,685,000 pounds of clean cotton. As however the imports that year were very high, let us suppose that 350 millions of pounds is the quantity imported into England annually, and as a general average, that one acre produces 100 lbs. of clean cotton, then 3,500.000 square acres of surface or about 5469 square miles, are required to supply the English market with that one commodity: to cultivate which, at the rate of 100 persons per square mile 5,46,900 persons are employed; and to convey the produce to England 1,56,250 tons of shipping, or about 157 ships of 500 tons are required giving employment to upwards of 6000 persons to navigate them: add to these, the number of people employed in packing, conveying the article to the coast, embarking, relanding, &c. and we may perhaps fairly assume as a very low estimate, that not fewer than a million persons are engaged in supplying England with the raw material only, of her cotton manufactures.

The numbers employed in the construction of the machinery, and in the fabrication of the article into the thousands of shapes it is made to assume, it is quite impossible to say, but may perhaps, at a moderate estimate be stated at ten times that amount, when to that we add, that probably not one-twentieth of what is produced finds its way to England, we may well say, that cotton is the most valuable product of the vegetable kingdom.

The production of an article conferring so great commercial advantages on any country enjoying a soil and climate suited for the growth of the plant, becomes an object of the first importance, and has, more especially of late years, attracted much attention in India, in the hope of enabling her, by improving the quality and increasing the quantity of cotton grown for exportation, to compete, in supplying the English market, with America, though the latter

is a country, apparently enjoying every advantage for its successful culture, one from which by far the best cotton has hitherto been derived, and which, contributes nearly 8-tenths of the quantity imported into England: realizing there, for her most ordinary kinds, from 20 to 30 per cent. more than the average prices of all those sorts. of East Indian extraction, technically known under the name of Surats. Is it probable that we shall ever be able to accomplish this object? and if so, by what means are we most likely to succeed in so far improving the staple of our cottons, as to place them on a par with those of America? These are important questions to this, as a productive country, and as such, ought, especially the first, to be well considered before an answer is given, since, if in the negative, it might have the effect of discouraging enterprise, and thereby, very materially tending to establish its own correctness, while, on the other hand, if answered confidently in the affirmative, might have the effect of leading to very injurious expenditure in a hopeless speculation.

The plan and limits of this work, not less than the short time allowed by the rapidly revolving months to devote to the elaboration of a comprehensive article on the subject, prevents me taking it up in all its bearings, I shall, however, endeavour to present a summary of what has been ascertained, and thence proceed to deduce such conclusions as will, I trust, prove a safe guide to future cultivators.

I stated above that in the English market even the cheapest sorts of American cotton, usually sell, from 20 to 30 per cent. higher than the East Indian sorts or '*Surats*' as they are technically denominated in the Price Currents. Under these circumstances it became desirable that measures should be adopted to improve the Indian staples, with the view of placing them upon a more equal footing with the American, and the most obvious means of doing so appeared to be, to import seed and cultivate the American plant in India. It was, however, objected to this plan that as the Indian cloths, were more lasting or wore better than those fabricated from American cotton, that the Indian cotton was in reality better than the American, and that if more pains were bestowed on its cultivation, so as to render it a more marketable article, that it would from its own intrinsic merits supercede the latter. This objection was however readily answered by assuming, which is probably the fact, that the superiority of Indian cloth was not so much attributable to the quality of the cotton, as to its being used in a more favourable condition, and still more, by its not being injured by the application of acids, &c. in the bleaching.

On these grounds, and on the supposition that it might be easier to improve the cultivation by inculcating a little additional care in the management of a new and higher priced article, than by attempting to introduce any alteration in the management of one, which had been cultivated from time immemorial, and though not according to the most approved system, yet well enough to answer every useful purpose. Under this last view of the case, which to the best of my knowledge is strictly correct, it seems desirable to introduce as far as possible, the cultivation of some of the foreign sorts, were it for no other purpose than to establish improved modes of culture and preparation of the indigenous kinds, the quality of which, when well prepared, is considered but little inferior, if not, indeed, fully equal to Upland Georgian. To promote this object the Court of Directors with the concurrence and advice of the Board of Control, resolved in 1829, to establish experimental cotton farms under the Bombay presidency for the introduction of foreign sorts, especially the Upland Georgian and New Orleans, both belonging to the kind called "short staples" (from the shortness of the fibres of their wool,) and believing that it owed its superiority, partly, to the mode of cleaning, sent also American machines to separate the cotton from the seed.

The better to give these experiments every chance of success by diffusion, large quantities of American seed, accompanied by a copy of Captain Hall's instructions for its cultivation and the method of cleaning the produce as practised in America, was sent out in the course of that and the succeeding years to Bengal and Madras, and the Governments of these Presidencies instructed to distribute it among each of their Collectorates for experimental cultivation.

The seed thus received was accordingly distributed, but owing to accidents and delays too commonly attendant on first attempts, the greater part spoiled and failed to vegetate, and of that which did grow much was afterwards lost, some owing to improper soils having been selected, but by far the greater portion owing to the season, so far at least as the Madras Presidency was concerned, proving one of the most unfavourable that could be imagined for such an experiment. Extreme drought and famine prevailing generally throughout the country,

cotton, and every thing else was neglected by the starving cultivators, who were intent only, on procuring food enough to maintain life.

So general a failure in the first experiment has proved most unfortunate, as it has tended to damp enterprise and destroy that hope of better success in after trials which would have resulted from success, however partial, in the first attempt, and seems to have put an almost entire stop to the further prosecution of these experiments, in which, by the way, the natives never seemed to take much interest, partly perhaps through apathy, but more probably, because they were frightened at the anticipated additional trouble and expense without seeing any very certain prospect of adequate remuneration. This was more to be regretted, as success can scarcely be anticipated where the parties engaged in rather expensive and troublesome experiments have no direct interest in the result. The civil establishment could have none, and though they were, from their better knowledge of the advantages likely to accrue to the country from success, most willing and anxious to promote the introduction of the new kinds, yet being hampered by the strictness of the regulations of the service, were prevented aiding and stimulating to the extent that might have been required, native efforts for its attainment, added to which, was the uncertainty existing, on the part of the growers in the interior, of finding a ready market for an article less esteemed by the native manufacturer than their own short stapled but strong cotton, in the manufacture of which, long practice had conferred perfect facility. Impediments such as these are not to be overcome unless by persons who are really interested in the result, who can devote much of their time to the superintendence of the cultivation, can at all times command a ready market for their produce, and lastly, who have a considerable amount of capital to invest in the business.

The mere distribution of seed to ryots will not accomplish these ends in their present state of ignorance, poverty, and depression, for they at once say, the cost of ploughing and preparing the ground is so much, suppose this new seed is bad, or the plants do not thrive, or I do not know the proper seasons to sow, and gather in the harvest, who is to pay me for my lost time and labour, or to provide that proportion of support, for myself and family, that I would have derived from a crop of our own, less valuable it may be, but yet well known cotton, which I know how to cultivate, and which long experience informs me will not disappoint my expectation. This I cannot say for yours, since I never saw it growing, and as I am a poor man with a large family, I dare not engage in speculative experiments.

That such is the true source of aversion on the part of the natives to engage in these new kinds of cultivation, and neither apathy nor indifference to their own interests, of which they have a keen perception, is rendered evident by the fact, that in those districts, Salem, Tinnevelly, and Coimbatoor, where the cultivation of Bourbon cotton has taken firm root under the superintendence of European Merchants, the natives cultivate it of their own accord, as readily or nearly so, as the indigenous country cotton, well knowing, that the crops of it are as certain as those of the other, and the demand for it equal if not greater. The American, short stapled cottons can be cultivated as easily and with equal certainty of success in these districts, but are actually discouraged, though they succeed well, as being more troublesome and expensive to clean, and much less valuable, both as an article of export commerce, and for domestic consumption among themselves, than the Bourbon cotton.

These instances, though the only ones I know, of unquestionable success on a large scale, prove indubitably the existence, in the Southern provinces of the Peninsula of India, of a soil and climate favourable for the production of these, in Europe, more esteemed varieties, and go far I think to show that if they have not succeeded elsewhere, that it is mainly for want of the proper encouragement being held out to the only persons qualified to cultivate them at a cheap rate, the native cultivators ; which, on this side of India, may be fairly attributed to the want of European speculators, possessed of sufficient capital and enterprise to give the necessary impulse ; as it is through European enterprise alone, that success has been attained to the extent here stated. In this conviction I am farther confirmed, from the result of experiments I have had in progress during the last twelve months, on too small a scale, it is true, to admit of any very certain conclusions being deduced, but still, such as to convince me, that with no other care than they receive in field cultivation, that both the Bourbon and short stapled American cottons may be successfully cultivated in our common alluvial soils, but more profitably in the red ones, which are largely charged with the red oxide of iron. The long stapled or sea island cotton has not succeeded with me, not because the plants themselves have been more delicate or less adapted to

our climate than the others, but because they are subject to the attacks of an insect, which deposits its eggs in the young fruit, causing blight and destruction of the produce long before it attains maturity.

The Pernambuco variety (*Gossypium acuminatum*) promises to succeed better, and being a strong growing shrub producing a very long stapled cotton, may prove a very useful addition to our stock.

It appears from the facts adduced, that the soil and climate of this portion of India, are far from unfavourable to the growth of the foreign varieties of the cotton plant, and equally that they produce cotton of good quality, but whether equal to that of American growth I am unable to say. Mr. Fischer of Salem, the Principal Cultivator on this side of India has altogether discontinued cultivating it, not on account of the inferiority of its produce, but because it is greatly inferior as an article of commerce to the Bourbon variety and much more troublesome and expensive to clean and fit for the market, and then, does not fetch so high a price by nearly 50 per cent. But though that is the case in the ferruginous soils of Salem, it does not follow that it would prove equally so in other districts where the soil is entirely alluvial and argillaceous, since in such soils, my experiments have led to the conclusion that the American short staples are more productive, and answer upon the whole better, than the Bourbon, while, from the rapidity with which they come to maturity, they are as susceptible, as the indigenous sorts, of being cultivated as an annual, which, in the opinion of the natives, might be thought an advantage.

Having I trust satisfactorily shown that in the southern provinces of India, the American short stapled cottons can be cultivated with equal ease and certainty, under the same course of treatment, as the indigenous kind, it only remains to ascertain whether the produce is intrinsically equal in value, or in other words whether fabrics manufactured from it possess the recommendation of wearing equally well. On this point I confess myself unable to afford any satisfactory information. The belief of the natives as above stated is adverse to the supposition that the American cotton is equal in that respect to the Indian, but their conviction is formed from comparing imported European cloth, with native fabrics, which I do not consider fair subjects of comparison, in as much as India was, in the first instance and for a long time after, supplied with old cloths, the refuse of European warehouses, which had been deteriorated by long keeping and more or less by the processes employed in bleaching in Europe to which Indian cloths are not subjected. The result of my own experience, as well as of several others with whom I have conversed on the subject, is in favour of the supposition, that European cloth is fully equal to Indian, and I have no hesitation in adding, that native cloth which I have had made up to express order, and of the most costly quality, did not wear nearly so well as European cloth purchased 100 per cent. cheaper from the boxes of strolling hawkers. From this I infer American cotton grown in its own country, is at least equal to Indian, but whether when grown in India it retains its good qualities, remains to be determined, on that point I am unable to give any precise information, and for the present leave the matter as I found it *sub-judice*.

The fact of Bourbon cotton of Indian growth, having sold in the London market for the highest prices going, and I believe I may safely add, always 100 per cent higher than the native cottons or 'Surats' leaves no room to doubt its excellence, and some specimens of cloth fabricated from that kind have been acknowledged, in this country, to be of the first quality.

While thus endeavouring to the utmost to introduce new varieties it must not be overlooked, however much of the native partiality in favour of the indigenous cotton we may attribute to prejudice, that, notwithstanding it is generally badly prepared and dirty, it bears a fair and steady price in the English market, and is in constant demand for mixing with the American kinds, thus proving almost to demonstration, that in the estimation of the English manufacturer it possesses valuable properties, and even leads to the inference, that we might be more usefully employed in directing our energies to its improvement, than in devoting so much labour and capital to the introduction of an exotic, only adapted for successful culture on particular kinds of lands, and these well suited for other kinds of cultivation, while it is less, or not at all fitted for culture on the Black soils, especially adapted for the production of the indigenous sorts, which, on the other hand, are not so well adapted for the general purposes of agriculture. Could then anything be done to improve the quality and marketable value of the Indian cotton ?

To me it appears that much might be done towards the attainment of this object. According to the system usually pursued in native husbandry, the soil is rarely, if ever, manured, is but indifferently ploughed, the seed are never changed, but that from the same stock constantly resown, and that too broad cast usually, so thick that the plants choak each other in their growth, the young shoots are never topped, in short nothing is done having a tendency to improve the quality or increase the quantity of the produce by invigorating the plant while the land is still farther exhausted and the plants still more choaked, by crops of other grain being taken off, while the cotton is advancing to maturity, and when the crop is at length ready to gather, no care is taken in the gathering to keep it clean and free from dry and broken leaves, and what is much worse, when a great demand for the article exists, the ryots have even been known to gather the green pods and ripen them in the sun, in place of allowing them to ripen and open on the stalk, much to the injury ot the good name of Indian cotton, more especially of that of Tinnevelly, which used to be in high esteem, but has, I am told, recently fallen into disrepute owing to that cheat having being practised in 1833-4. Ought we not then to endeavour, to the utmost, to elevate the culture of the indigenous cotton, and by ascertaining its intrinsic value and cost of production, determine by comparative returns the respective value to the country of the two kinds; for it may be found that our cottons make a better return to the country at 6*d*. than the American ones do at 8*d*. per pound, owing to the much smaller cost of production and larger amount of produce from the same extent of land.

These however are points which I am certain will never be ascertained while the culture is left entirely in the hands of natives, as they have not the means of securing a regular succession of new seed, or of bestowing extra expense on the cultivation, and gathering in of the crop, neither have they the intelligence or means of going in search of better markets, supposing them to have bestowed the requisite care to improve the produce, but must sell it on the spot, possibly at a rate but little higher than their neighbours get for an article of very inferior value, thus incurring a loss in place of a gain for the extra labour and care devoted to its production.

In thus urging greater attention to our native produce, I am far from wishing to discourage the cultivation of the exotic kinds. On the contrary, I feel quite convinced that the country would derive immense advantage from their more general culture, on the simple principle of their enabling us to bring extensive tracks of country under cultivation, that are now either waste, or of comparatively little value, since, on such the American cottons can be cultivated, while the Indian would altogether fail, it requiring a soil both rich and retentive of moisture for the attainment of its highest degree of perfection. Another, and in native practice not the least important, recommendation of the American short stapled cottons is the rapidity with which they mature their first crop,(the time required being even shorter, than that for our native cotton) and their larger produce of wool in proportion to the quantity of seed; but then, the seed are considered less wholesome for feeding cattle, which, should such be found to be the case, will prove a very heavy drawback if not an almost insurmountable obstacle to its general introduction as an article of native agriculture.

I shall conclude this article with a few remarks appertaining to the history of the species, and varieties figured in the accompanying plates. *Gossypium Barbadense* is one of the oldest species of the genus, having been established by Linnæus on the authority of a figure of Plucknet (Tab. 188, Fig. 1,) published 1691—Mr. Royle remarks of it, "but this figure may answer equally well for some other species" a remark, in which I do not concur, for, with the exception of the leaves being a little narrower, than we usually find them in the plant as cultivated in this country, they are most characteristic, and the figure altogether a very passable one, of our Bourbon cotton plant. This species we are informed by Swartz is most extensively cultivated in the West Indies, and thence, according to Roxburgh, it was brought to the Islands of Bourbon and the Mauritius, whence again, it was introduced into India under the name by which it is known here, Bourbon cotton. On its first introduction into these Islands the plant seems to have found a soil and climate in every respect suitable, and rapidly became an article of great commercial importance, both on account of the fine quality and of its wool, and of its extreme productiveness; in both of which respects, however, it has recently fallen off so much, that the lands which were formerly appropriated almost entirely to its culture, are now more profitably employed in the culture of sugar. This deterioration may be owing to two causes, first neglecting to renew the stock from time to time by fresh importations of seed, and secondly to the soil itself, having been injured

by a too constant repetition of the same kind of crop. A similar deterioration formerly took place in the West Indies, and to so great an extent, as to lead to the almost total discontinuance of the cultivation of cotton, which, as in the instance of the African islands, was succeeded by sugar, much to the profit of the cultivators. It seems probable, that if the cultivation of cotton was resumed in the West Indies from seed carried either from this country or the Mauritius, that those islands in which the produce of the sugar cane is beginning, from long culture, to deteriorate, might be much more profitably devoted to the cultivation of cotton. In Malta, Spain and Sicily, in all of which places cotton is cultivated to a considerable extent: much attention is given to frequent changes of seed, each supplying itself from one or other, of the other two. If similar attention was bestowed in India to such interchange of seed between remote districts, there can scarcely be a doubt, it appears to me, that all would benefit. The cultivators of Bourbon and American cottons will do well to bear in mind the examples of the West Indies and the Mauritius, and not only attend to the occasional renewal of their stock of seed from the original source, but also to refresh the lands under cultivation every few years, by taking not one, but a succession of crops of different kinds off those tracts which have been long under cotton cultivation with only short intervals of rest. The other two varieties of *G. Barbadense* here figured, the long and short stapled kinds, or " Sea Islands" and " Uplands," as they are called, are derived from the same stock as the Bourbon, and were with much difficulty introduced into North America owing to the shortness of the summer season. The former indeed could not be established until the fortunate occurrence of a very mild winter permitted the roots to live through it, and produce an early crop of fresh shoots in the spring. These bore and ripened a crop, the seed of which was found sufficiently hardy to resist the cold of spring, and matured a crop of excellent cotton in the course of the succeeding autumn.

The produce was a variety intermediate between the Pernambuco and Barbadoes, or Bourbon, cottons ; having the long staple, smooth black seed, and 5-lobed leaves of the former, with the free or detached seed of the latter. The peculiar and very superior qualities of this kind, are attributed to its growing in a soil highly calcarious, and strongly impregnated with salt, aided by the influence of a " saline atmosphere." To this last, though much dwelt upon by American writers, I feel disposed to attribute much less importance than to the character of the soil in which it grows. All attempts, so far as I have yet been able to learn, to introduce this kind into India have failed, the pods are said to be blighted in the bud, and the few that attain maturity are generally more or less injured by the attacks of caterpillars, such I have invariably found to be the case in all my attempts to raise it. The Egyptian cotton which in that country partakes largely of the valuable properties of this kind, is supposed to have been derived from the Sea Island stock ; however, judging from some that I had sown in my garden, it has either got mixed with the short stapled sort, or is in course of transition into it. The latter I rather suspect to be the case, but whether or not, it is most certain that, from a quantity of Egyptian seed sown in Madras both kinds were produced, and having the distinctive characters of each strongly marked; that produced from smooth seeds according in every particular with the produce of Sea Island seed received direct from America, even to its liability to attacks of insects and consequent blight of the young pods; while that from rough downy seed equally corresponded with the green seed, or " Uplands" growing on the same plot of ground. The fact here stated is an interesting one, and one which it is my intention still further to investigate so soon as I can procure a fresh supply of seed direct from Egypt, for that from which my plants were raised was not such, but saved in Madras, from plants however, raised from seed received direct from that country.

Respecting the origin of the Uplands variety, and the period of its introduction into North America, I am not so well informed, but I have no hesitation in considering it another variety of *G. Barbadense*, from which in fact it scarcely differs except in the much greater size of the pods, the shorter and stronger staple of its wool, the usually 5-lobed leaves, and the seeds more or less clothed with down. This last is a mark of very minor importance, as it is now known, a single generation may change the character of the seed from smooth to downy: those of the Bourbon cotton, are generally described as black and smooth, yet I have scarcely ever met with one that was not more or less downy, and often not less so, than the American green seed. This (Uplands) variety thrives well in India, producing abundance of very large pods, so large indeed that of a number I weighed, the contents rarely fell short of 70 grains, and some, picked ones, even exceeded 100, while those from the indigenous

cotton, growing on the same price of ground, barely weighed 25, and large pods of Bourbon under 50 grains. The proportion of wool to seed in the American was about 30 per cent., in the others from 20 to 25—to which may be added, as a further recommendation, that the former produced ripe pods in less than three months from the time of sowing!

The most advantageous time for sowing this kind is, I believe, towards the end of the rains in December, or with the first of those in April and May, when they happen to fall freely. Should the following dry season be protracted, of course watering would greatly augment the crop. My Egyptian (Uplands) cotton was not sown until late in the season, it grew well and produced a very abundant crop, the pods being by far the largest I had seen, but nearly the whole was lost owing to the setting in of the heavy October rains before they were quite ripe. A second, and abundant, but in all other respects much inferior crop was subsequently produced, the bushes being apparently much injured by the strong blighting north winds of January and February, from which they never recovered. I have since cut them down nearly to the ground and manured them, in the expectation of restoring them to vigour, but owing to the hot dry weather, and artificial watering being purposely withheld, hitherto with but partial success, a few only of the bushes having grown strongly, the others continue puny; those however that have shot vigorously promise a very abundant crop, the seed from which will of course be subjected to farther trials.

The *Gossypium acuminatum* as observed above seems to be very extensively distributed, since it is brought to India under the various names of Pernambuco, Peruvian, and Bahea cotton, and is spoken of in the Agri-Horticultural Society's transactions under the name of Ava cotton, and lastly is by Dr. Roxburgh, " said to be a native of the mountains to the north and westward of Bengal," but he adds " I do not find this species is ever cultivated." From this last remark we may infer it is not a native of India, but has accidentally found its way here, and up to the time that Roxburgh wrote, had not become sufficiently known, for its value to be justly appreciated. However as Roxburgh's information regarding its native country may be correct, and as his name is expressive of a Botanical character rather than of a native country to which the species is not limited, I have preferred adopting it. This is a very strong growing plant, and as it bears apparently without injury the high temperature of this coast, it is probable, it merits, and will receive, more attention than has hitherto been extended to it. In the light sandy soils of the coast it seems to thrive remarkably well and is very productive.

Respecting the indigenous species, (*G. herbaceum*) it is unnecessary to dilate, that one being already so well known in India, and indeed over all the warmer portions of the old world, from the south of Europe, the northern limit of its cultivation, through the whole of the torrid zone, and as being the species first and best known to mankind generally.

Remarks on Genera and Species. In this as in most very natural orders considerable difficulty is experienced in finding good generic characters, by which to distinguish groups of species which evidently ought to be kept distinct from each other, but the difficulty of discriminating among the species and varieties is often much greater, and has been productive of the usual result, that of causing an excessive multiplication of species, by inducing Botanists, working with imperfect materials, in numerous instances, to raise mere varieties, to the rank of species. *Gossypium* affords a striking example of this fact in a cultivated genus : those of Sida and Abutilon are scarcely less remarkable among the uncultivated ones. Some species of each are common to the tropical regions of both the old and new world, and have in nearly all such cases received distinct names according as they happen to come from the one or other. Did the multiplication stop there, we would have little to complain of, as the geographical character would of itself, in the absence of botanical ones, serve to distinguish them, and prevent any serious confusion, but unfortunately it does not ; our *Abutilon indicum* for example has in India, in my opinion, on most inadequate grounds, been split into two, viz. *A. indicum* and *A. asiaticum*, and has besides at different times received a variety of other names, such as *Sida populifolia, Sida Eteromischos, Sida Beloere*, &c. but under how many more names it figures in tropical America and her islands is not easy to discover.

In the discrimination of the genera of *Malvaceæ*, reference is principally had to the involucrum and fruit, and generally these, combined with habit, afford very permanent generic

characters : by the involucrum for example *Malva* and *Althea* are principally distinguished. The principal distinguishing characters between *Hibiscus* and *Abelmoschus* appertain to the calyx, in the former its segments are distinct, while in the latter they continue to adhere, presenting the form usually called spathaceous, that is, splitting along one side only, like a spathe. The carpels being many or few seeded, afford subsidiary characters, but that taken from the calyx is essentially the distinguishing one, as many species of *Hibiscus* have carpels with a plurality of seeds, but few, if any, have the spathaceous calyx. Upon the whole however, I think there is reason to doubt the propriety of breaking down even very large genera on such grounds. *Abutilon* and *Sida*, which want the involucrum and were formerly united, have on somewhat similar, but much better grounds, been separated. In *Abutilon* the carpels are membranacious or bladdery, and contain several seeds : in *Sida* they are 1-seeded, usually coriacious, and furnished at the apex with a double beak. *Thespesia* is separated from *Hibiscus* on account of its truncated undivided calyx, resembling the cup of an acorn, and *Paritium* on account of its imperfectly 10-celled capsule, caused by the bending inwards of the margins of the valves.

It seems questionable whether it is judicious to take leading generic characters from the involucrum, Linnæus objected to the principle, and laid it down as a rule, that they ought always to be taken from the fructification only, by which he meant the calyx and organs embraced by it ; but in the case of the *Malvaceæ*, nearly all of which are referable to his class and order *Monadelphia polyandria*, and also in *Umbelliferæ*, he found it convenient to depart from his own rule, and got over the difficulty by calling the involucrum an external calyx. Dr. Zenker has, (Plantæ Indicæ) in his genus *Hymenocalyx*, our *Abelmoschus angulosus*, carried this departure from the Linnean rule to excess, by founding a genus on the circumstance of the involucrum as well as the calyx occasionally splitting spathaceously, for with that exception, which I have since ascertained is not constant, there is absolutely no difference between that genus and *Abelmoschus*, and ought not in my opinion, to be retained.

The spathaceous involucrum of that species which completely conceals the calyx, led Mr. Arnott and myself into a curious error, by inducing the belief that it was the calyx, and that the involucrum was so early caducous that we had no opportunity of describing it.

The genus *Dyctiocarpus* which associates with *Sida* in wanting the involucrum, and in having 1-seeded carpels, I ventured to separate on account of its definite stamens, which had previously caused it to be removed from the order and referred to *Byttneriaceæ*. The curiously reticulated testa of its seed affords another good character, as being one which I am not aware of existing in any other species of the order. The genus *Decaschistia* is remarkable for its 10-celled and 10-valved, capsule, with a solitary seed in each cell. For further illustrations of the several genera of this rather large and complex order, I must refer to my Icones, with the aid of which, I hope to be able to afford most ample illustrations of the genera of all the larger and more important orders to be treated of in the course of this work.

The following additions have been recently made to the order.

Urena repanda—Of this little known species I have at length got specimens, from Goomsoor (unfortunately rather imperfect,) through the kindness of W. G. Davidson, Esq. I find it does not correspond very accurately with the generic character of Urena : neither does the specimen agree well with the character of the species, but as the species of this genus are apt to vary considerably in their forms I have no doubt of its being the same plant, as it agrees in one or two important points. These peculiarities lead to the suspicion that it ought to be removed from the genus, though in habit it associates very closely. The most prominent features of distinction between this and the other species of the genus consists in its having both the involucel and calyx campanulate, 5-cleft, or rather toothed at the apex, and completely enclosing the carpels, which, in place of being globose and armed all over with hooked prickles, as in the rest of the genus, are only slightly convex exteriorly, and nearly triangular. The very distinct form and large size, as compared with the rest of the genus, of the involucel and calyx, added to the different shape, and glabrous exterior of the carpels, lead to the supposition that it ought to form a separate genus. The habit however, and the peculiar reticulation of the leaves, which coincide exactly with some other species of Urena, induce me for the present to leave it as a doubtful member of that genus, the more so as my specimens are in fruit only. The leaves in them are nearly round, slightly acuminated at the point, cordate at the base, repandly dentate on the margin, and pubescent on both sides with a single gland beneath ; the flowers numerous, the peduncles axillary several flowered, and from the abortion of the leaves, racemose towards the ends of the branches.

Though my specimens are imperfect, yet as this plant is very little known, I shall endeavour to have it figured in my Icones.

Hibiscus trionum—This species I found in considerable abundance in very dry gravelly soil near Cuddapah, in 1834. I have not since met with it in any other locality.

Abelmoschus angulosus W. and A.

Hymenocalyx variabilis, Zenker's Neelgherry plants.

Had not this plant been previously named *angulosus* Dr. Zenker's specific name would have been most appropriate, as I find from numerous specimens collected on the Pulney mountains that it is a variable plant. There it grows to the height of several feet, the leading branches terminating in long dense spikes of large flowers. The fruit as represented in Zenker's figure seems to me much too long and tapering, and in that respect differs so much from my specimens that I should almost have been induced to consider them distinct species did they not agree well in every other respect.

Abutilon Neelgerrense (Munro's M.S.S.)—Suffruticose, sub-glabrous : leaves roundish, deeply peltato-cordate, acuminated, unequally crenato-dentate, whitish beneath: peduncles about the length of the petiols, several flowered, (2-8-10 Munro) corolla spreading, petals obovate, united below into a short tube, hairy at the orifice, tube of the stamens glabrous, carpels about 9, truncated, nearly twice the length of the lanceolate, acuminated, villous sepals.

Neelgherries not unfrequent—Specimens of this fine species were communicated by Lieut. Munro, who found them in several localities.

In the great size and form of its leaves it is closely allied to *A. polyandrum*, from which however, it is readily distinguished by its umbellate flowers, and more numerous carpels ; by this last mark it is equally distinguished from *A.* (Sida D. C.) *umbellatum* and *A.* (Sida) *Leschenaultiana*, which have umbellate flowers and 5-carpelled fruit.

This appears a very handsome species, the larger leaves exceeding in their smaller or transverse diameter 7½ inches. The fruit altogether resembles those of *A. indicum*, except in the carpels being fewer and less hairy ; the flowers too, nearly correspond except that in *this*, the petals are hairy at the base where their union ceases, and the tube of the stamens is glabrous, whereas in *that*, the filaments are very hairy and the corolla glabrous.

In addition to the preceding I have received a specimen of what appears a new genus, but unhappily too imperfect to admit of my attempting to characterize it. It has the involucrum of Pavonia, with the fruit of Abelmoschus. It was sent along with several other plants from Goomsoor, by W. G. Davidson, Esq. but unfortunately so much injured in the drying as to be unfit for more minute examination and description.

EXPLANATION OF PLATE 27.

1. Branch of Gossypium acuminatum, showing the flower and full grown capsule.
2. Staminal column, formed by the union of the filaments into a tube embracing the style.
3. Proper calyx, (enclosing the ovary) style, and stigma; the involucel leaves and corolla being removed to bring these parts into view.
4. Ovary cut vertically.
5. Mature pod open.
6. Seed and cotton.
7. Column of firmly adherent seeds.

All natural size except the cut ovary, which is a little magnified.

EXPLANATION OF PLATE 28—*a. b.* and *c.*

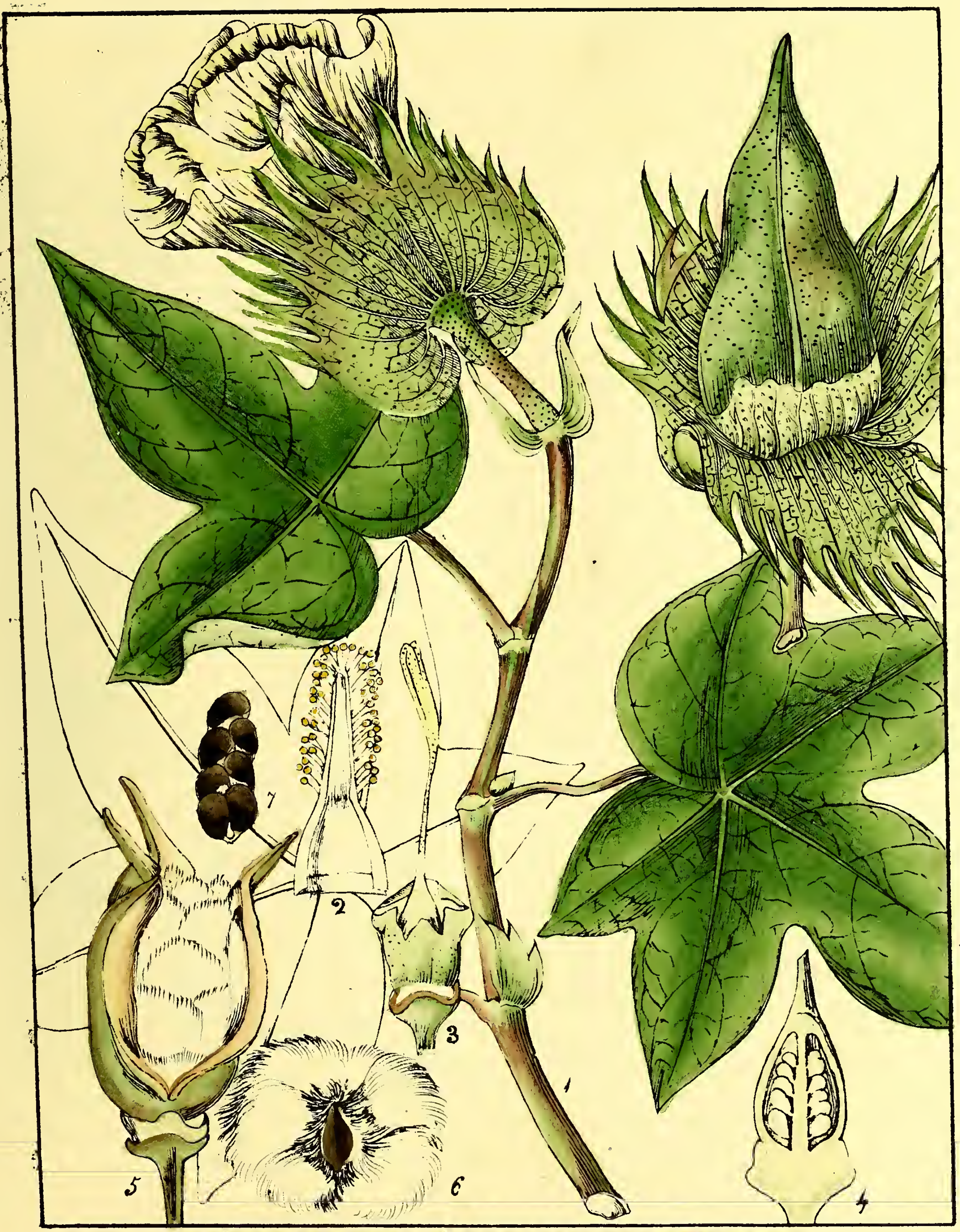
1. Gossypium Barbadense—*natural size.*
2. Two detached stamens showing the one-celled anthers—*magnified.*
3. Ovary, style, and stigma, the calyx partly removed to show the ovary—*natural size.*
4. Ovary cut transversely—*magnified.*
5. Ripe capsule as it appears on first bursting, and before the valves have fully opened.

Plate 28 *b*. Sea Island cotton. Same as the preceding, except—9. The cotyledons removed and unrolled, radical inferior, and seen in the plate pointing towards the figure 9.

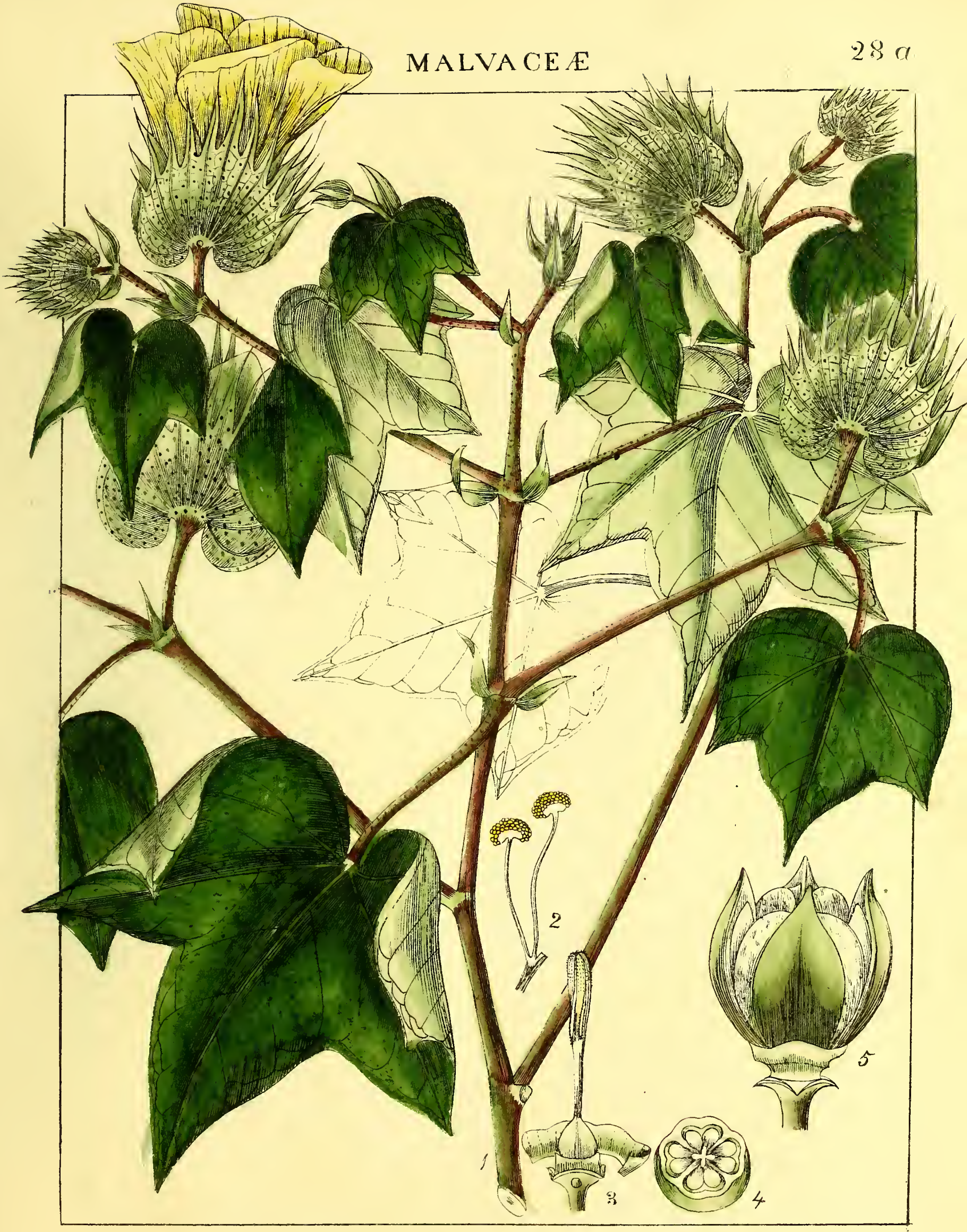
Plate 28 *c*. Upland Georgian cotton, the same as the preceding, except—8. A seed cut transversely—*magnified.*

XXIII.—BOMBACEÆ.

This is a small order consisting almost entirely of tropical trees and shrubs, but remarkable for embracing among the number the largest tree yet known, namely, the *Adansonia digitata.* The prominent distinctive features between this and the neighbouring orders, *Malvaceæ* and *Byttneriaceæ*, is found in their anfractuose anthers and in the calyx, which in this, is campanulate or tubular from the union of the sepals, in these polysepalous from the sepals remaining altogether distinct, or only adherent at the base. In other respects they are so much alike, that Bartling (*ordines naturales &c.*) proposes to reunite the *Bombaceæ* with *Malvaceæ*, as a section only of the latter order, while Dr. Lindley on the other hand, following Endlicher, thinks them more justly referable to *Byttneriaceæ*, of which, in his arrangement, they accordingly form a portion. Between such authorities I presume not to decide, and shall therefore follow the beaten track by continuing to adopt the arrangement of our Prodromus, according to which the *Bombaceae* form a distinct order intermediate between these two, leaving to future and abler Botanists, the task of determining which is right. In habit they are mostly arborious or shrubby,

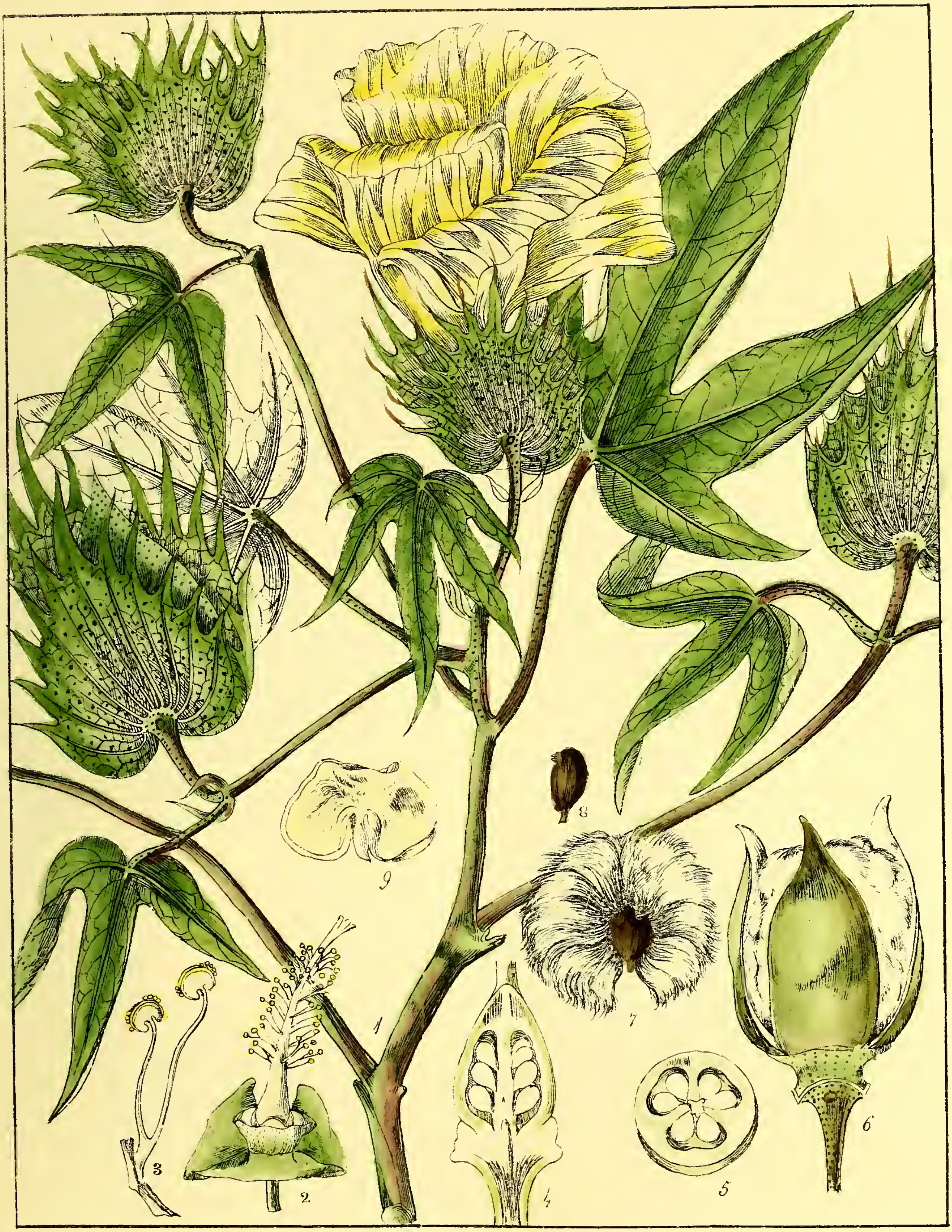


GOSSYPIUM ACUMINATUM ROXB



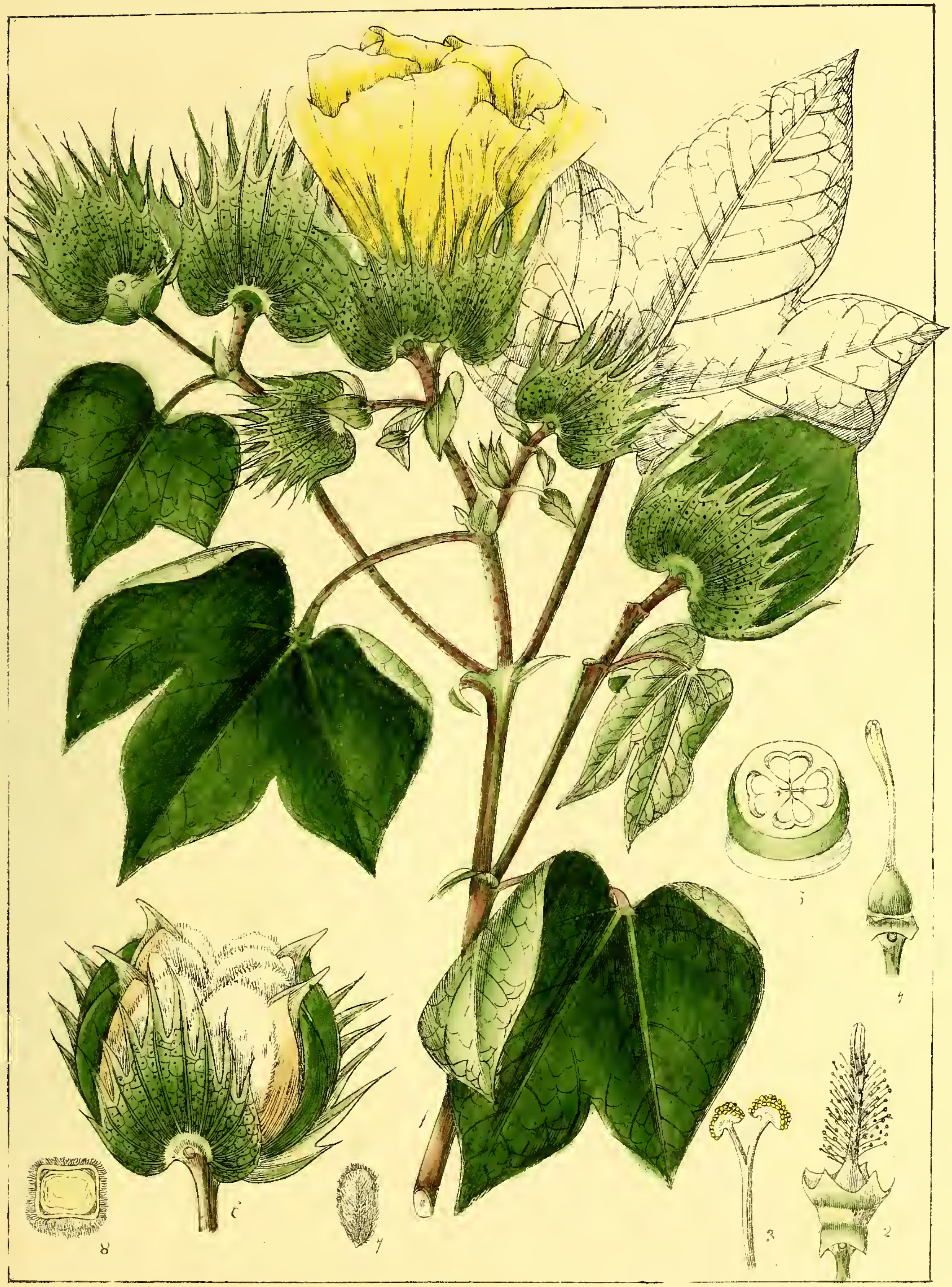
GOSSYPIUM BARBADENSE a

Barbados or Bourbon Cotton



Gossypium Barbadense β

Sea Island or long Stapled Cotton



GOSSYPIUM BARBADENSE V

Upland Georgian or Short Stapled Cotton

the leaves are alternate, having stipules, and the pubescence on the young and herbaceous portions, stellate as in *Malvaceæ*.

The following is the character of the order as given by DeCandolle and others.

" Sepals 5, cohering in a campanulate or cylindrical tube, which is either truncate, or with 5 divisions: at the base of this, on the outside, are sometimes a few minute bracteæ. Petals 5, regular; or sometimes none, but in that case the inside of the calyx is coloured. Stamens 5, 10, 15, or more; filaments cohering at the base into a tube, which is soldered to the tube of the petals, divided at the apex into 5 parcels, each of which bears one or more anthers, among which are sometimes some barren threads; anthers 1-celled, linear, reniform or anfractuose. Ovarium consisting of 5 carpella, rarely of 10, either partly distinct or cohering strictly, and dehiscing in various ways; styles as many as the carpella, either distinct or more or less coherent; ovula 2, or many. Fruit variable, capsular, or indehiscent, usually with 5 valves, septiferous in the middle. Seeds often enveloped in wool or pulp; sometimes albuminous, with flat cotyledons; sometimes exalbuminous, with shrivelled or convolute cotyledons. Trees or shrubs. Leaves alternate, with stipulæ. Pubescence of the herbaceous parts stellate."

Affinities. The plants referred to this order are said to be distinguished from *Malvaceæ* on the one side by their Polyadelphous stamens and habit; and from *Byttneriaceæ* or *Sterculiaceæ* on the other, by their 1-celled anthers; and from both, by their gamosepalous (sepals united into one) calyx. Such are the distinctions which induced Kunth in his dissertation on the *Malvaceæ*, to propose their separation as an independent order. The opinions of some able Botanists, as has been already observed, are unfavourable to this separation, though approved by most, one recommending their being retained as a section of *Malvaceæ*, while others prefer arranging them among the *Byttneriaceæ*, thus affording a pretty convincing proof that the original distribution of Jussieu was nearly correct, and that Botanists will probably do well to revert to it, or at all events to reduce *Bombaceæ*, by referring one section *Helictereæ* to *Byttneriaceæ*, and the other, *Bombaceæ* to *Malvaceæ*. To me it appears certain that the order as constituted by Professor Kunth can scarcely be maintained, since *Helicteres*, with the single exception of the gamosepalous calyx, differs so widely from *Bombax* the type of the order. In this genus the filaments are united throughout into a tube bearing on the apex ten distinct, imperfectly 2-celled anthers, (the division is transverse and rather indistinct) while in *Bombax*, they, being all united at the base only, and broken into irregular parcels with 1-celled or anfractuose anthers, seem rather to place it, as Bartling has done, among *Malvaceæ*: on this point however, I refrain from offering any decided opinion, as I am not aware of the modifications, that most accomplished Botanist, Professor Endlicher of Vienna, proposes to introduce into the character, by which to unite both under his order *Sterculiaceæ*, and at the same time exclude them from *Malvaceæ*. Whatever they may be, it is certain that these orders must always remain more nearly united to each other, than to any others, and stand as a warning against lightly departing from Jussieu's original distribution of the natural orders. Mr. Brown, while he departs from the letter continues to adopt the spirit of Jussieu's arrangement, in so far as, that he looks upon his order *Malvaceae*, to which he (Mr. Brown) adds *Tiliaceae*, as forming a large class; an idea, in which he has been followed by Bartling, Lindley and Martius, who combine the whole under their class *Columniferae*, the former however, splitting the order *Byttneriaceæ* into as many distinct orders as other Botanists make sections, denominating them respectively *Sterculiaceæ*, *Byttneriaceæ*, *Hermanniaceæ*, and *Dombeyaceæ*, assigning the following abbreviated or synoptical characters to the class and orders.

Class. *Columniferae*.—Segments of the calyx valvate in æstivation! Petals hypogynous twisted, rarely by abortion wanting Ovaries several free or combined. Leaves alternate, stipulate.

Order.—*Tiliaceae* calyx deciduous. Anthers 2-celled. Filaments free. Albumen fleshy. Embryo erect.

—— *Sterculiaceae* calyx deciduous. Corolla wanting. Anthers 2-celled extrorse. Embryo erect in the axis.

—— *Byttneriaceae* calyx persistent. Petals with the claws concavely vaulted, *(concavo-fornicatis)* sometimes aborting. Anthers 2-celled. Seeds often albuminous.

—— *Hermanniaceae* calyx persistent. Stamens 5. Anthers 2-celled extrorse. Albumen between farinacious and fleshy. Embryo curved.

—— *Dombeyaceae* calyx persistent. Petals flat. Stamens monadelphous, some definite multiple of the number of the petals. Anthers adnate, 2-celled extrorse. Albumen fleshy.

—— *Malvaceae.*—Calyx persistent. Stamens monadelphous. Anthers 1-celled. Under this last the *Bombaceae* are arranged on account of their 1-celled anthers.

To this class Von Martins adds *Depterocarpeae,* and Lindley *Lythrarieæ.* In so large an assemblage presenting so few and so slight modifications of structure, it is not to be wondered at that Botanists should have found it difficult to determine the limits of each of its subdivisions, since in truth the peculiarities of the above orders are scarcely greater than we meet with in sections of other orders, and yet, the varieties of habit met with in each are such as renders it in every way desirable that they should be distinguished; while the number of species referable to each subdivision, makes it preferable to distinguish them under a separate name rather than to unite the whole under a single denomination. This has successfully accomplished, by classing them under one common name, and distributing the minor groups under so many others.

Geographical Distribution. The *Bombaceae* properly so called constitute but a small order. They are all tropical plants, for the most part large trees, and most abouud in America: those of Asia being limited to a few genera, with rarely more than two species to each—three or four only are found in Africa, among which however, is that most extraordinary of trees, the Colossus of the vegetable kingdom, the *Adansonia digitata,* a tree, which has been estimated to live thousands of years, and the trunk of which is said sometimes to attain the astonishing circumference of 80 or 90 feet, and to afford in its hollow, when decayed by age or disease, accommodation for several families. The cotton trees of this country afford the most genuine examples of the order. *Helicteres Isora,* a very common shrub in India, readily distinguished by its curiously twisted fruit, I look upon, as above remarked, as less meriting a place here, though generally referred to the order. The Durian so celebrated on account of its fine flavoured but excessively fœtid fruit, is a representative of the order peculiar to the eastern shores of the Bay of Bengal, but totally unknown on the western, though our genera are all found on the other coast, and more or less copiously scattered all over India.

Properties and Uses. Musilagenous and emollient properties are common to the whole of the *Columniferae.* The juice of the roots of *Bombax ceiba,* an American tree, is said to be aperient, while the bark of the tree is emetic. Blume (medical plants of Java) states that the bark of the root of *B. Malabarica* is emetic, and is employed as such in Java. The *Eriodendron anfractuosum* or *Bombax pentandrum,* produces a gum which is esteemed for its medicinal properties in this country, but being usually administered in combination with aromatics, it is probably indebted to them for much of its supposed virtue. The woolly cotton which envelopes the seed of both these species is remarkable for its softness, and is much and deservedly esteemed for making cushions and bedding, owing to its freedom from any tendency to become lumpy and uneven by getting impacted into hard knots. Various attempts have been made to fabricate it into cloth, but hitherto without success, except a sort of very loose texture, which the committee of the Society of Arts, to whom some specimens were sent, pronounced only fit for quilting Lady's muffs and boas, but thought, that for such purposes it was superior to woollen or common cotton stuffs, the looseness of its texture rendering it an excellent non-conductor, while its extreme lightness supplied the other desiderata required in an article employed for such a purpose.

The *Adansonia digitata* is in high esteem among the Africans—all its parts abound with a thick mucilaginous juice, which they draw by tapping, and use in various ways. The wild bees perforate and form cavities in its young wood, which is very soft and tender, for the purpose of lodging their honey, which is much sought after. The young leaves dried and powdered constitute the *Alo* of the negroes, which they use as a condiment, and suppose that it moderates excessive perspiration. The fruit, which somewhat resembles a citron in shape, is filled with a redish spongy pulp, of a sweetish acid taste, enveloping the seed, of which agreeable and refreshing acidulous drinks are prepared, and employed as a cooling beverage in the fevers

so frequent in Senegal: mixed with tamarinds it is considered by the natives a certain cure for dysentery, while the gum is equally prized as a remedy against heat of urine. As this tree is not uncommon in India now, and as I can bear testimony to the correctness of the description of the sensible qualities of the pulp, it seems desirable that it should be subjected to some trials to ascertain whether the curative properties attributed to this substance, not by vulgar report only, but by attentive medical men, who have had many opportunities of observing its effects and have themselves used it, are such as they describe. According to the predominating theories of the day, all these intestinal affections are attributed to an inflammatory or sub-inflammatory state of the lining membranes of the intestines, for which acidulous emollient drinks are strongly recommended. Such a combination of acidulous and aperient emollients seem therefore well suited to fulfil the indications of cure laid down for the treatment of the milder forms of these complaints, and which, according to the French school, are the only certain ones in the cure of these diseases so frequent in hot countries and seasons. We are indebted to Dr. Louis Frank, a French physician, who witnessed the mode of treatment pursued in dysentery in the caravans travelling from Nubia to Cairo, and had in that situation an opportunity of observing the good effects of the remedy, which he afterwards most successfully adopted, for much of the information we possess regarding the medical properties of the fruit of the Boabab tree. I extract his account as given in Merat's and DeLens' Dictionnaire Universel de Mat: Medicale, of the method of using it for the cure of dysentery.

On the first appearance of the disease the patient restricts himself to a very spare diet, using for drink a weak decoction of tamarinds. If the disease does not speedily abate he then has recourse to the fruit of the Boabab, which some precede by small doses of rhubarb. It is the spongy redish friable substance of the fruit that is used. If there is no amendment at the end of a few days, a paste is made of the powdered bark of the fruit mixed with water, of which about the size of a chesnut is given several times in the course of the day, and sometimes a drink is prepared of the torrified seeds, of which the patient takes repeated doses daily.

In one case of dysentery of twenty-five days standing, in which Dr. Frank prescribed this fruit " it cured as if by enchantment."—Many other patients were thus treated with equal success.

The following interesting account of this tree was drawn up by Dr. Hooker, and published in the Botanical Magazine, Nos. 2791—92.

" The ADANSONIA *digitata*, ETHIOPIAN SOUR GOURD, MONKIEY BREAD, or BAOBAB, is a native of Senegal. It is said likewise to be found in Egypt and Abyssinia, and is besides cultivated in many of the warmer parts of the world. There seems to be no question that it is the largest known tree; the diameter of the trunk, Adanson says, being sometimes no less than thirty feet. Although it has been introduced into Britain, according to the Hortus Kewensis, so long ago as the year 1724, by William Sherard, Esq. yet, as may be supposed, so vast a tree is not likely, in our stoves, to arrive at that size, when its flowers and fruit may be expected. Hence, I trust, that representations of so great a rarity, taken, in part, from drawings made in India, and kindly lent to me by Major General Hardwicke, and in part, from specimens of the fruit and flowers sent to me in spirits, by Mr. Guilding, from St. Vincent, may be generally acceptable to the Botanical world.

Adanson, during his visit to Senegal, has given a full and interesting account of this tree, and, certainly, not the least striking circumstances respecting it are, its enormous size, and its great age, whence it has been called " *Arbre de mille Ans*," and whence too, Humboldt has been led to speak of it as, " *the oldest organic monument of our planet*." Its trunk, indeed, great as is its diameter, has a height by no means proportionable to its breadth. Adanson calculates as follows: That a tree of

1 year old is	1 in. or $1\frac{1}{2}$ in. diameter,	5 in. in height.
20	1 foot	15
30	2	22
100	4	29
1000	14	58
2400	18	64
5150	30	73

The roots, again, are of a most extraordinary length, having numerous ramifications. In a tree, whose trunk was only ten or twelve feet high, with a trunk seventy-seven feet in circumference, Adanson has determined the main branch, or tap-root, to be one hundred and ten feet long. A figure of the whole tree may be seen in a beautiful vignette, at p. 141, of Lord Macartney's Embassy to China, drawn from a fine specimen in St. Jago, one of the Cape de Verd islands. The foliage there, indeed, is not so abundant as to conceal the vast proportion of the trunk, but it often happens, that the leaves are so numerous, and the branches spread out, drooping at the extremities, to such a degree, that the trunk is almost entirely concealed, and the whole forms a nearly hemispherical mass of verdure, from one hundred and forty to one hundred and fifty feet in diameter, and sixty or seventy feet high.

The wood is pale coloured, light, and soft, so that, in Abyssinia, the wild bees perforate it, for the purpose of lodging their honey in the holes, which honey is reckoned the best in the country. I know not that the wood itself is applied to any particular purpose, but the Negroes on the eastern coast of Africa employ the trunks in a certain state to a very extraordinary purpose. The tree is subject to a particular disease, owing to the attack of a species of Fungus, which vegetates in the woody part, and which, without changing its colour or appearance, destroys life, and renders the part so attacked, as soft as the pith of trees in general. Such trunks are then hollowed into chambers, and within them are suspended the dead bodies of those who are refused the honor of burial. There they become mummies, perfectly dry and well preserved, without any further preparation or embalmment, and are known by the name of *guiriots*.

This plant, like all of the neighbouring order of Malvaceæ, is emollient and mucilaginous in all its parts. The leaves dried and reduced to powder constitute *lalo*, a favourite article with the natives, and which they mix daily with their food, for the purpose of diminishing the excessive perspiration to which they are subject in those climates, and even the Europeans find it serviceable in cases of diarrhæa, fevers, and other maladies.

The fruit is, perhaps, the most useful part of the tree. Its pulp is slightly acid and agreeable, and frequently eaten; while the juice is expressed from it, mixed with sugar, and constitutes a drink which is valued as a specific in putrid and pestilential fevers. Owing to these circumstances, the fruit forms an article of commerce.* The Mandingos convey it to the eastern and more southern districts of Africa, and through the medium of the Arabs, it reaches Morocco and even Egypt. If the fruit be decayed or injured, it is burned: the leys are boiled with rancid oil of palm, and the negroes use it instead of soap."

I shall now conclude these, I fear, rather too extended remarks on Adansonia, which the interest of the subject has led me into, by extracting from the Flora Senegambiæ, a short account of its mode of growth. "It is surprising that in a country so hot and dry as the western coast of Africa, the Boabab can acquire such enormous dimensions. Individuals are often found in Senegal and Gambia having a circumference of even 60 or 80 feet, without however attaining a height in proportion to such thickness. These dimensions diminish in proportion as they recede from the sea coast. This singular vegetable seems to increase in diameter without our being able to attribute this effect solely to the influence of the leaves, since it is deprived of them during nearly two-thirds of the year. The herbaceous envelope, of a shining green colour, by which the shapeless mass of its trunk is covered is very thin but full of life. From the slightest wound we can make in it, there bursts forth an abundant stream of liquid, a kind of nutritive sap, coming from the herbacious envelope which answers the same purpose as leaves, and which, so to speak, has been the principal focus of vegetable life. In a word the Baobab has a vegetation analogous to that of certain Cacti, which draw their nourishment not from the soil but from the air by their whole surface."

The Durian so much esteemed to the eastward is said by Rumphius, to be of a very heating quality; and liable to excite inflammatory derangements of the system. Whether these statements are in accordance with the results of modern experience is more than I can tell, but I rather suspect not, as all who have been able to reconcile themselves to the odour of the fruit

* In Bowdich's account of Banjole, it is mentioned that this fruit possesses an agreeably acid flavour, and, being very abundant, it forms a principal article of food among the natives, who season many of their dishes with it, especially a kind of gruel made of corn, and called *Rooy*. Mr. Bowdich further observes, that this tree loses its leaves before the periodical rains come on.

speak of it in the highest terms, and seem to think it not less wholesome than grateful to the palate. It is remarkable that it has never been introduced on this side of the Bay, as it certainly seems a most desirable plant to have among us.*

Remarks on the Genera. Three indigenous genera only of this order are found in the Indian Peninsula, and are described in our Prodromus under the names of *Helicteres, Bombax,* and *Eriodendron.* These names Professor Endlicher of Vienna, in the course of a revision of the order has seen reason to change. The species, which originally formed the types of these genera are all of American origin, and on being carefully compared with the Indian species which have been associated with them, were found to differ so much, as to render necessary the separation of the Asiatic from the American forms. Under such circumstances, it was incumbent on him in separating the former as new genera, to retain the old names with the American forms, to which they had been originally assigned, and give new names to the Indian ones. Whether the new genera recommended by him will be adopted by other Botanists is still uncertain, but that the readers of these remarks may have an opportunity of judging for themselves of the propriety of the changes, I append, for comparison, the generic characters of both the American and Indian genera, but without for the present, offering any opinion of my own on the propriety or otherwise of the change, as I have not yet had an opportunity of satisfying myself on that point by a comparison of the plants themselves, and written characters do not always convey, to the mind, a very clear or satisfactory idea of the differences which may actually exist, and be very apparent to the eye, though not easily described.

In addition to the species here figured there is another, or a very distinct variety found at Courtallum, approaching in some respects to Wallich's *B. insigne,* in the large size of its flowers. It differs, I think, specifically from *B. Malabarica,* in having the petals linear, nearly twice the length of the stamens ; the stamens many times more numerous, the filaments much more slender and filiform, and the anthers small in proportion. The flowers being fully twice as large as those here represented, and the relative proportion in the size of the parts being changed, added to the capsule being hard and woody, leaves scarcely a doubt on my mind of its being distinct, but notwithstanding, I refrain for the present from naming it as such, owing to my specimens being imperfect, and not sufficient to admit of my adequately characterizing the species from them.

Helicteres L. Calyx tubulosus bilabiatim 5 fidus. Petala ligulata, ungue appendiculata, bilabiatim disposita. Staminum tubus carpophoro connatus, longe exsertus. Filamenta fertilia 5—10 ; sterilia 5 petaloidea, paribus fertilium staminum opposita. Ovarium longe stipitatum e carpellis 5 (cum staminibus sterilibus alternantibus). Styli contorti. Stigmata obsoleta. Fructus e carpellis 5 distinctis, spiratim contortis l. rectis, polyspermus. Semina angulata, albuminosa. Cotyledones convolutæ.—Frutices præcipue Americæ tropicæ, foliis latecordatis crenato-dentatis dense tomentosis, floribus cymosis terminalibus, albis vel rubro-fuscis.

Isora. Calyx clavato-campanulatus subinflatus 5 fide bilabiatus, labio superiore producto. Petala ligulata bilabiatim disposita, 3 inferiora exappendiculata, superiora 2 appendiculo unilaterali maximo. Staminum tubus carpophoro connatus, longe-exsertus in urceolum ovarium cingentem ampliatus, filamentis sterilibus 5 liguliformibus minutis .... capsulæ 5 in spiram arcte contortæ. Species indicæ. *Is. corylifolia* (Hel. Isora L.). *Is. grewiaefolia* (Hel. grewiaefolia Cand.).

Eriodendron DC. Calyx irregulariter sub 5 fidus. Petala erecta. Tubus stamineus medio ampliatus apice in 5 crura divisus, antherosomata bilocularia longitudinaliter adnata recta gerentia. Stigmata connexa unicum capituliforme mentientia. Capsula lignosa 5 locu-

* Since the above was written I have learned from General Bishop that there are two trees growing in Trichinopoly, and one of them has twice borne a single fruit, but on neither occasion brought it to maturity ; the first blighted on the tree, the second was blown down after it had attained a considerable size.

laris, 5 valvis. Semina lana pericarpii obducta.—Americanæ foliis digitato-compositis, floribus magnis albis.

E. leiantherum DC.

Gossampinus. Calyx irregulariter 5 fidus. Petala erecta. Tubus stamineus basi ampliatus, apice in crura 5 divisus, antherosomata lunata flexuosa 2—3 distincta gerentia. Stigmata connexa in stigma capitato-subrotundum. Capsula 5 locularis, 5 valvis, cortice crasso duro rugoso, basi dehiscens. Semina lanæ immersa.—Indica foliis digitato-compositis, floribus minoribus flaventibus.

G. Rumphii (Bombax pentandrum orientale Auct.).

Salmalia. Calyx subtruncatus irregulariter ad basin usque rumpens. Petala tandem revoluto-recurva. Tubus stamineus pluriserialis, in phalanges poly-1. monostemones plures divisus, cruribus (phalangis divisiones ultimæ) simplicibus. Antheræ extrorsum affixæ reniformes, interiorum staminum geminatæ majores, exteriorum simplices minores. Stigmata in lobos 5 radiatim-posita. Cetera Eriodendri.—Indicæ foliis digitato-compositis, floribus speciosis coccineis.

S. insignis (Bombax insigne Wall.). *S. malabarica* (Bombax heptaphyllum Roxb.).

Bombax. Calyx irregulariter 3—5 fidus extus eglandulosus. Petala 5 patentia v. reflexa. Tubus stamineus in phalanges polystemones 5—v. plures divisus, cruribus 2 fidis. Antheræ erectæ oblongæ, loculis confluentibus marginalibus 1 loculares. Stigmata in capitulum 5 sulcatum coadunata. Capsula 5 locularis, 5 valvis, placentis incrassatis. Semina lana pericarpica obducta.—Americanæ, foliis digitatis, floribus spicatis, albidis.

B. Ceiba L. B. Munguba Mart. *etc.*

EXPLANATION OF PLATE 29.

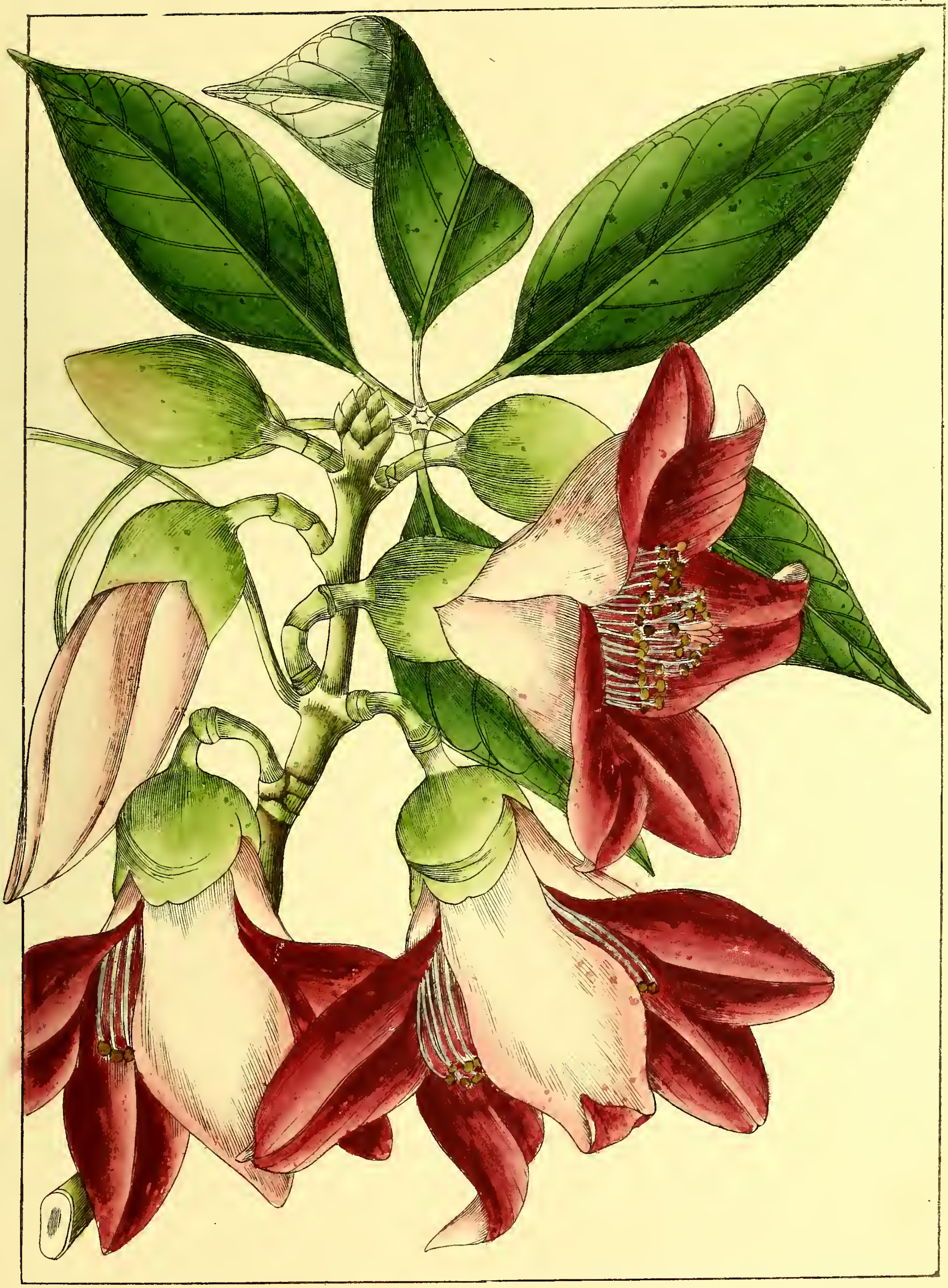
1. Bombax Malabaricum—*natural size.*
2. A flower, the corolla removed to show the calyx and stamens.
3. Portion of the same removed from the calyx, showing the short tube formed by the union of the base of the filaments round the ovary.

4 and 5. Anthers.
6. Ovary style and stigma.
7. Ovary cut transversely—*all more or less magnified.*
8. Full grown capsule before bursting.
9. Mature capsule burst.

XXIV.—BYTTNERIACEÆ.

A large and very complex order, consisting almost entirely of tropical plants, and presenting every variety of form of vegetation, from the slender creeping herb up to the most stately trees.

In their fructification different groops present so great variations in form that some Botanists have proposed dividing them into four or five distinct orders,but generally, as they all agree in having a valvate œstivation, 2-celled anthers, and similarity of sensible properties, it seems preferable to keep them together as a single order, distributed into sections, such as *Sterculieae*, *Byttnerieae*, *Hermannieae*, *Dombeyaceae*, &c. To the sections proposed by DeCandolle, Endlicher, as already stated, adds two, referred by most other Botanists to the last order, namely *Helictereae* and *Bombaceae*. Under *Bombaceae* I have already presented a summary of Bartling's arrangement, and will here in preference to attempting to give a general view of the whole order present the characters first of Endlicher's three sections, and subsections so far as they refer to the Indian flora, and then complete the view by adding from other sources those which are left, as yet, untouched by Endlicher, merely premising, that the whole are essentially characterized, by having a wholly superior ovarium of several carpels combined into a solid pistil with the



முள்ளிலவமரம்
Moolloo Elava Marum

BOMBAX MALABARICUM (DC.)

ముళ్ళబూరుగమాను
Moolloo Booraka Manoo

BOMBAX MALABARICUM (DC.)

placentas in the axis : valvate œstivation of the calyx : monadelphous stamens ; 2-celled anthers : and alternate stipulate leaves. All Indian plants having the above combination of characters, ought to find a place in one or other of the following sections. Tiliaceæ and Elæocarpeæ two very nearly allied orders are distinguished, the former by its distinct stamens, the latter by its lacerated petals.

Tribe I—*Helictereae.* Flowers bisexual. Calyx irregular. Corolla irregular. Filaments either united into a tube longer than the ovary, or embracing the carpophore (pedicel of the fruit,) and free at the apex; anthers 2-celled, with an obsolete transverse septum. Ovary sessile or stipitate. Fruit with the carpels either distinct, or cohering, one or many seeded. Seeds albuminous. Leaves simple.

* * Eupilectereæ Tube of the stamens elongated, embracing the stipe of the ovary. Filaments free at the point, each bearing a single anther.—To this subsection our Helicteres isora (Isora corylifolia End.) belongs.

Tribe II—*Sterculieae.* Flowers by abortion unisexual, calyx having the sepals united regularly. Corolla none. Filaments united into a tube adhering to the carpophore anthers imperfectly one or two celled, oblong-curved, situated at the base of the perfect or imperfect ovary. Fruit pod-shaped of several verticelled carpels, opening along the interior sature. Seed sometimes covered with an arillus, albuminous. Trees with simple or digitately compound leaves, with the petiol tumid at the apex.

To this section our genera *Sterculia* and *Heritiera* belong. The former, as left by Roxburgh and DeCandolle, is completcly broken down and now affords the types of no fewer than nine distinct genera, seven of which appertain to the Indian flora, the characters of these I shall add at the conclusion of this article.

Tribe III—*Bombaceæ.* Flowers bisexual. Calyx 5-cleft, often irregularly divided, the œstivation then obscure. Corolla regular or none. Filaments united into a tube, covering the ovary. Anthers solitary or several cohering, cells indistinct or confluent, often anfractuose. Ovary sessile. Fruit capsular composed of cohering carpels. Seeds albuminous or exalbuminous, often enveloped in wool or even in pulp.—To this section the genera quoted under the former order belong.

Tribe IV—*Byttnerieæ.* Flowers bisexual. Calyx 5-partite or 5-sepaled, without an involucel. Petals frequently concave and vaulted at the base, expanded at the apex into a strap-shaped appendage. Stamens 10—30, or more; the five that are opposite to the sepals sterile and strap-shaped; the others, opposite to the petals, either solitary or pentadelphous, the bundles rarely bearing only one anther. Ovarium sessile, 5 celled; cells usually 2-ovuled. Seeds sometimes exalbuminose with thick cotyledons; sometimes albuminose with foliaceous, plane, or convolute cotyledons. Trees, shrubs, or very rarely herbaceous plants. Leaves alternate, entire, or sometimes cut. Stipules twin. Peduncles axillary, opposite to the leaves, and terminal, one or many flowered.

To this section the Cacoa tree, (Theobroma) and the bastard cedar tree (Guazuma) and several other Indian genera belong.

Tribe V—*Hermannieæ.* Flowers bisexual. Calyx 5-lobed, persistent, either naked or with an involucel. Petals 5, spirally twisted in œstivation. Samens 5, monadelphous, all fertile, opposite to the petals. Carpels united into a single fruit. Albumen between fleshy and mealy. Embryo included: radical inferior, ovate: cotyledons flat, leafy, entire. Shrubs or herbaceous plants. Leaves alternate, simple, or variously cut. Stipules 2, adhering to the petioles. Peduncles axillary, or opposite to the leaves, or terminal, with 1, 3, or many flowers, which are usually in umbels.

To this tribe *Riedleia* and *Waltheria* belong. The former as left by DeCandolle a very confused genus, demanding a careful revision, as it certainly includes within itself the types of several. None of those referred to it from India are genuine species. *Riedleia truncata* I have removed to *Malvaceæ*, and of our three other species, which I think, should be reduced to one, Dr. Arnott has formed a new genus under the name of *Lochennia.*

Tribe VI—*Dombeyaceæ.* Calyx usually with an involucel, 5-partite or rarely 5-lobed. Petals 5, flat, rather large, unequal-sided, convolute in œstivation. Stamens some multiple of the number of petals, in a single row, monadelphous, sometimes all fertile, but usually 5 of them sterile and filiform or strap shaped. Styles 2, 3, 5, or 10, distinct, or united together. Ovules 2, placed side by side, or several, in two rows in each cell of the ovarium. Embryo straight, usually in the axis of a fleshy albumen. Cotyledons leafy, often bifid, crumpled or flat.

To this tribe *Pentapetes, Melhania, Pterospermum* and *Kydia* belong. The two former genera are for the most part composed of small herbaceous or suffruticose plants, the latter of handsome flowering trees. They are all widely distributed over the Peninsula. *Dombeya,* which is a fine flowering shrub and a favourite in gardens, is a doubtful native of Southern India.

Tribe VII—*Eriochlæneæ Arn. Wallicheæ* D.C. Calyx 4-5 partite or lobed, with a 3-5 leaved involucel. Petals 4-5 flat. Stamens numerous in a multiple series, the outer ones shorter, all united into one conical column as in *Malvaceae:* sterile filaments none, anthers 2-celled erect.—To this tribe one or perhaps two Indian genera belong. The one *Microchlæna,* which is abundant on the slopes of both the Pulney and on the Shevaroy hills, is a small stunted looking tree with rough cracked bark.

Affinities. A slight examination of the peculiarities of the preceding tribes will show how difficult it must be to draw up any character suited to include the whole order without introducing so many contradictions as to render such a one almost useless in practice, and yet, it is generally easy to distinguish the members of the order. They are nearly allied to *Malvaceæ* and *Tiliaceæ,* from the former of which they are separated by their 2-celled anthers, and from the latter by their monadelphous stamens.

Geographical Distribution. This as already observed is mainly a tropical order, being nearly confined to the tropics, but widely distributed over those regions of both the old and new world. Of the tribes above enumerated, it may be mentioned that *Sterculieæ* are principally of Indian and African origin; a small proportion only being found in America. Roxburgh in his Flora Indica describes 12 species of *Sterculia*—Blume has seven from Java, Wallich in his list of Indian plants increases the number to twenty-two for all India, while Humboldt has not one from America, of the whole order, excluding *Bombaceæ,* Java has according to Blume 22, the Indian peninsula 33, and Equinoctial America from Humboldt's collections 27. The *Dombeyaceæ* are all either Asiatic or African, but I believe predominate in the former. Of *Hermannieæ,* a small proportion only are found in India, and a considerably greater number in Africa, especially about the Cape. Those found in Senegal are pronounced by the authors of the Flora Senegambiæ to be identical with the Indian ones. *Byttnerieæ* are principally from South America and the West Indies, and there the most important plant of the order, the Cacoa tree, is indigenous. *Eriochlineæ* are few in number, and with one or two exceptions of Indian origin. Supposing *Helictereæ* and *Bombaceæ* to belong to this order, India can boast of but few of either tribe, while they are numerous in America.

Properties and Uses. The plants of this order, in common with those of the whole of the class *Columniferæ,* abound in mucilage, and possess in a pre-eminent degree emollient properties. One of the African species of *Sterculia* affords a gum, known as the gum *Tragacanth* of Sierra Leone, whence called *S. tragacantha* by Dr. Lindley. The seeds of another species *S. acuminata,* affords the *kola* of the Africans, which, when chewed, has the curious property of making bad and half putrid water, that may be afterwards drank, taste sweet and agreeable.

The pod of *Sterculia fœtida,* a common Indian tree, is, according to Horsfield, employed in Java as a remedy against gonorrhœa, and an American species of *Waltheria* is used in Brazil for similar purposes, for which it is fitted by its mucilaginous properties; the Indian species, *W. India,* enjoying analogous properties might be rendered available here, for the same object, if prepared as a diet drink. In Martinique, the mucilaginous bark of *Guazuma ulmifolia,* a tree very common in India, is employed to clarify sugar. It might along with some others

especially the fruit of *Microchlœna*, which is highly mucilaginous, be converted here to a similar useful purpose, and affect a great saving in the process adopted in India for that object. The inner bark of some species, which in all is very tough and pliable, is employed for making cordage, that of *Sterculia guttata, Microchlœna spectabilis,* and *Abroma augusta*, are particularly specified by Mr. Royle as being so employed, of the latter it is said, it " abounds with strong white fibres which make a good substitute for hemp, and as the plant succeeds well in every part of India, grows quickly, and yields annually two, three, or even four, crops of cuttings fit for peeling it is particularly recommended by Dr. Roxburgh for cultivation." The seed of several species of Sterculia are roasted and eat by the natives of this country ; but by far the most important plant of the order, at least in a dietetic point of view, is the Cacoa tree. This is a native of America, and has been introduced into India. Hitherto our attempts at culture have not been very successful, but I saw several very thriving young trees at Courtallum, and there is one at Palamcottah which annually bears a crop of fruit, and gives promise that it might be increased. I attempted to take grafts from that tree, and also to propagate it by slips and gooties, but failed in both attempts. It seems very desirable to extend the cultivation of this tree in India, not only on account of the commercial advantages that might accrue from its produce, but for the benefit we might ourselves derive from it. In the former point of view it may be mentioned, that upwards of twenty million of pounds are annually consumed in Europe. The elevated table-land of Mexico being the native country of the Cacoa, where it enjoys a cool and humid climate, I presume the most probable tracts of country in India for commencing its cultivation, on a considerable scale, would be the high and cool table-land of Mysore, in plantations well sheltered, and still further kept cool and damp by being made in only partially cleared forests. Wherever such localities are to be found, the Cacoa may be expected to thrive, and might be introduced with effect and at little charge, On the Malabar coast too, where forest lands abound, the humid and insular-like climate would, as in the West Indies where it is very extensively cultivated, counteract the injurious effect of excessive heat, and render the chances of success, fully equal to those of Mysore. The only drawback to its extended cultivation is the slowness of its growth in the first instance, which however is well compensated for, by its after duration and productiveness. The fresh virgin soil, the shade, and humid atmosphere, of forests recently cleared of their brushwood only, are all dwelt upon by Humboldt as peculiarly favourable for Cacoa plantations, and in such of course they ought to be tried in the first instance, until we get the tree acclimated.

Remarks on Genera. The genus *Sterculia*, as mentioned above, has been completely broken down, and no fewer than nine genera formed from the apparently heterogeneous materials which were formerly combined under that name. The characters of these as given by Professor Endlicher, will be given below, and figures of several published in the early numbers of my Icones. *Heriteria* is a genus nearly allied to *Sterculia*—of which one species is found in Malabar, and another in Ava. *Guazuma* is said to have been introduced from America, whether correctly may be difficult to ascertain, but whether or not it is certainly very widely diffused over India now, and affords a proof, if introduced, that it has found a most congenial climate, and holds out the prospect of equal success attending the introduction of the Cacoa tree. The wood which is generally known under the English name of bastard cedar, though a light and rather loose grained timber, is much employed in making furniture. Ranking next this large umbragious tree is *Byttneria*, a humble herb, only found in dry gravelly soil, usually seeking the support and shelter afforded by the few stunted bushes growing in such situations. The Abroma I have never met with, but as above stated, it merits being better known on account of the valuable purposes to which its bark may be applied. Waltheria is a very common herbaceous plant, but of a most variable description, in so far as external appearance goes, being sometimes glabrous, at others hairy, and at others again covered with a thick coat of whitish down or shag, thus appearing as if there were several species. This genus is remarkable in the order for having a one-seeded coccus.

Pentapetes another of the few herbaceous genera of this order are principally marsh plants. *P. phœnicia*, which is met with in marshy grounds all over India during the cool season, is also found in the Tenaserim provinces, and I may here mention as an instance of how little things common about our own doors, however beautiful, attract attention, that I once had spe-

cimens of this plant, raised with much care from seed brought from Rangoon, sent several hundred miles as one of the greatest beauty and rarity, but which, had never been seen by the cultivator in India, though he must have passed it hundreds of times. The plant is really a beautiful one and richly merited all the attention bestowed on that occasion, but would equally have merited it if brought from the neighbouring marsh, in place of from a foreign country. *Melhania* is not very common, though widely diffused, but like some other members of the order is very variable. The *M. incana* when growing in a fertile soil, changes so much in appearance from what it is in a more arid one, that it no longer seems to be the same plant, and indeed I greatly doubt whether the two forms can belong to the same species, I have since the publication of our Prodromus met with a new species having much the appearance of an Abutilon, hence called *C. abutiloides.* It grows in rocky ravines among the Ballagaut hills, and attains the size of a small shrub.

The determination of the species of the genus *Pteraspermum,* is an undertaking of considerable difficulty, owing to the great variations in the form of the foliage in different specimens of the same species. In my recent excursions I have added a new species to this genus, and have reason to suspect that there are several, yet unknown to us, to be met with in our alpine jungles. I had not the good fortune to find fructification of some that I consider new, and cannot in consequence describe them, but their trailing arborious habit, leave little reason to doubt their being different from all those already described.

Kydia, a genus established by Dr. Roxburgh, and so called in honor of the late Colonel Kyd, the founder of the Calcutta Botanic Garden, consists of fine shrubs, bearing their numerous flowers in large clusters on the ends of the branches. Of this genus there is one species met with in the Pulicat jungles towards the foot of the hills, and one very fine new species in Ceylon, to which Dr. Arnott has given the name of *K. angustifolia,* a peculiarity by which it is well distinguished from the continental forms which have the leaves nearly round.

Other two genera are characterized in our Prodromus as belonging to the order, namely, *Eriochlœna* and *Microchlœna.* At the time of publication we expressed a doubt of the stability of both these genera, conceiving that the characters assigned by DeCandolle were insufficient to keep them distinct. Of the justice of these doubts further observation has not only satisfied me, but have even led me to doubt, whether two plants described in our Prodromus under these names form more than one species, indeed I feel almost certain that they do not, and ought to be united. These genera are made to rest on the circumstance of one having a quinary the other a quaternary series of parts, a difference of every day occurrence in different specimens taken from the same tree, and of course more likely to occur when taken from different trees, though of the same species. The following are the new genera of *Sterculieœ* proposed by Professor Endlicher in his Meletemata Botanica.

Tribus. Sterculieæ. Flores abortu diclines. Calyx e sepalis regulariter connatis, Corolla nulla. Filamenta in tubum carpophoro connexum connata. Antheræ subuni – 1. biloculares curvato-oblongæ, ad ovarii perfecti 1, imperfecti basin. Fructus e carpellis leguminiformibus verticillatis, sutura interiore dehiscentibus. Semina interdum arillo obducta, albuminosa. Arbores. Folia simplicia—1. digitato-composita, petiolo apice tumido.

Pterygota. Calyx campanulatus 5 partibus carnosus, apice reflexus. Tubus stamineus masculus cylindricus elongatus calyce inclusus, apice in urceolum expansus, antheris sessilibus in 5 fasciculos coacervatis onustus, fasciculis singulis superposite-subpentandris. Tubus staminum femineus vix ullus, antheræ imperfectae in 5 fasciculos superposite coacervatae, fasciculis carpellorum sinubus oppositis. Ovaria subdistincta multiovulata. Styli subsejuncti. Stigmata dilatata radiatim posita. Fructus carpella subglobosa longe stipitellata polysperma. Semina ala longa cultriformi (spongiosa) terminata.—Indiæ orientalis incola, foliis cordatis integerrimis, racemis axillaribus 1. alaribus, floribus majusculis rubro tinctis.

Pt. Roxburghii (Sterculia alata Roxb.).

Sterculia L. Calyx profunde 5 partitus patens. Tubus stamineus maris ac feminæ elongatus cylindricus, apice in urceolum 5 lobum expansus, lobis 3 dentatis, 3 antheriferis. Styli connexi abrupte recurvi. Stigmata .... Fructus carpella follicularia subsessilia polys-

perma.—Arbor generis typum praebens Indiam orientalem inhabitans foliis gaudet palmatim compositis, floribus laxe-racemosis, rubris, foetidissimis. Ceteræ species cum indica hac consociatæ simplicifoliæ, verosimiliter genus proprium (Ivira) constituentes, Americam tropicam incolunt.

St. fœtida L.

SOUTHWELLIA SALISB. Calyx campanulatus 5—7 fidus, laciniis apice connexis. Tubus stamineus masculus cylindricus calyce inclusus, filamentis apice liberis antheras in capitulum inordinate coacervatas gerentibus. Tubus stamineus femineus masculo conformis, antheris sterilibus 15—30 sessilibus, serie simplici sinuata dispositis onustus. Ovaria coadunata. Styli connexi recurvi. Stigmata subpeltata cohaerentia, radiata. Fructus carpella follicularia sessilia oligosperma. (Semina nuda.)—Orbis veteris, Africæ, Asiæ et Australasiæ tropicæ incolæ, foliis simplicibus v. compositis, floribus plerumque flavescentibus.

S. nobilis Salisb. S. Balanghas, S. versicolor, S. Blumii, S, Tragacanthæ, S, angustifolia, etc. (Steruliæ spec, Auct.).

CAVALLIUM. Calyx campanulatus 5 fidus, erectus. Tubus stamineus maris ac feminæ brevis, calyce inclusus medio constrictus, apice in filamenta 10 monanthera solutus, quorum 5 alterna longiora. Styli connexi breves. Stigmata coadunata 5 lobe-disposita. Fructus carpella coriacea follicularia sessilia oligosperma.—Indicæ, foliis cordatis lobatis, floribus paniculatis copiosis minutis.

C. urens (Sterculia urens Roxb.) *C. comosum* (Sterculia comosa Wallich.).

HILDEGARDIA. Calyx profunde 5 partitus reflexus. Tubus stamineus maris (?) et feminæ fusiformi-clavatus elongatus, antheris 10 bilocularibus duplici serie sessilibus; inferioribus 5 ovarii angulis oppositis. Styli continui connexi. Stigmata coadunata planiuscula minuta. Fructus carpella longe-stipitellata membranacea venosa, ventricosa, apice ala lata cultriformi terminata. Semina pauca (?),—Asiaticæ tropicæ, foliis cordatis acutis, glabris, membranaceis, floribus odoratis.

H. populifolia (Sterculia populifolia Roxb.) *H. Candollei* (Sterculia populifolia DC.) *H. macrophylla* (Sterculia macrophylla Vent.).

SCAPHIUM. Flores .... Fructus carpella stipitellata membranacea venosa, longe ante maturitatem aperta demum cymbaeformia magna. Semen unicum ad basin carpelli exsertum: —Indica, nobis e fructu tantum nota.

Sc. Wallichii (St. scaphigera Wall.).

FIRMIANA Marsigli. Calyx ad basin usque 5 partitus reflexus. Tubus stamineus maris et feminæ cylindricus elongatus, antheris plurimis. Ovarium e carpellis 5. Styli elongati. Stigmata .... Fructus carpella membranacea longe ante maturitatem aperta, demum foliorum adinstar expansa (dependentia?). Semina .... Arbor Chinensis foliis lobatis glabris.

S. platanifolia (Sterculia platanifolia L.)

ERYTHROPSIS Lindl. Calyx infundibuliformis 5 dentatus. Tubus stamineus maris et feminæ cylindricus exsertus, antheris 30 sessilibus inordinatis. Ovarium e carpellis 5 subdistinctis. Styli breves obsoleti. Stigmata acuta recurva. Fructus carpella stipitellata membranacea longe ante maturitatem aperta foliorum adinstar expansa dependentia. Semina 2 in quoque carpello marginibus alterne adhaerentia.—Arbor indica foliis lobatis, calycibus carpellisque rubro-coccineis.

E. Roxburghiana. (Sterculia colorata Roxb.).*

The following are the only additions to this order I have recently become acquainted with,

Melhania abutiloides. (Arn. MSS.) shrubby, diffuse; branches villous: leaves broadly ovate, cordate at the base softly pubescent above, whitish tomentose beneath, crenately serrated acute: peduncles axillary and terminal 2-3 flowered: involucel leaves broad cordate acuminated closely embracing the flower, persis-

* Meletemata Botanica by Schott and Endlicher, pages 32, 33.

tent: calyx segments tapering to a fine point, nearly twice the length of the involucel, but shorter than the oblong obtuse petals: stamens and sterile filaments united at the base: capsule tomentose.

M. Rupestries Wight's MSS.

Hab. Talapoodatoor among rugged broken rocks in the bed of a mountain stream.

This is a very rare species, which I have never met with since I first gathered it in 1834. It is evidently very closely allied to Wallichs M. Hamiltoniana a native of Pegu but differs sufficiently to entitle it to be looked upon as a new species. I adopt Dr. Arnott's name in preference to my own, though mine was first given, partly as being characteristic of the plant in place of the locality in which it grows, partly, and principally, because I believe the other is already published. Dr. A.'s specimens were gathered at the same time and place by Lieut. Campbell of the 50th Regt. N. I. who accompanied me on that excursion.

Pterospermum obtusifolium R. W. Arborious: leaves cuniate at the base, very broad truncated at the apex sometimes irregularly 2 lobed, or somewhat obcordate, the lobes coarsely toothed; glabrous above, under side covered with mealy whitish pubescence, reticulated with prominent veins: sepals linear, corolla densely covered externally with white stellate pubescence: capsules ovate, very obtuse or roundish at the apex, covered with dense rusty coloured furfuracious tomentum; seeds about 4 in each cell.

Habo Courtallum in dense forests.

This species comes nearest *P. reticulatum*, but the leaves are so totally distinct, that I cannot think of uniting them. I only found it in fruit, the description of the flowers is made from some old ones, more persistent than the generality, and is therefore imperfect, the involucel I have not seen.

In the same jungles I found *P. glabrescens*, *P. Heyneanum* and *P. rubiginosum*. The latter, except in the very peculiar form of its leaves, which are quite characteristic, much resembles *P. suberifolium* especially in its unexpanded flower buds. I have not yet seen either full blown flowers or capsules. *P. glabrescens* differs from all the other species I have seen in having its ovary supported on a long slender stypa or gynophore, and the sepals, which are linear, upwards of 5 inches long and only about ¼ of an inch broad, peculiarities well represented in Rheede's figure.

EXPLANATION OF PLATE 30.

1. Sterculia Balanghas flowering branch. *Natural size.*

2. A flower, showing the divisions of the calyx united at the apex. 3. Male flower opened. 4. Staminal column separated from the calyx. 5. A fertile flower, showing the ovary with the sterile anthers at the base and the lobed stigma at the apex.

6. Ovary cut transversely showing the 5 carpels with 2 rows of seeds in each.

7. A seed cut transversely.

8. The same cut vertically showing the erect foliacious cotyledons of the embryo. *All more or less magnified.*

EXPLANATION OF PLATE 31.

1. Guazuma tomentosa flowering branch *natural size.* 2. A flower full blown, shewing the vaulted petals with their strap shaped appendages. 3. The same, the petals removed to shew the tube of the stamens and the alternate, sterile and antheriferous filamenti. 4. A petal removed. 5. Antheriferous filaments removed, each composed of a bundle of united filaments free at the apex, and bearing a single 2-celled anther. 6. Ovary, style, and stigma, apex of the same with the style broken into its component parts, showing that it is composed of 5 slightly adherent styles.

7. Ovary cut vertically.

8. Cut transversely, showing its 5 carpels.

9. Mature fruit.—*Natural size.* 10. A capsula cut transversely. 11. Seed one cut transversely, *all more or less magnified.*

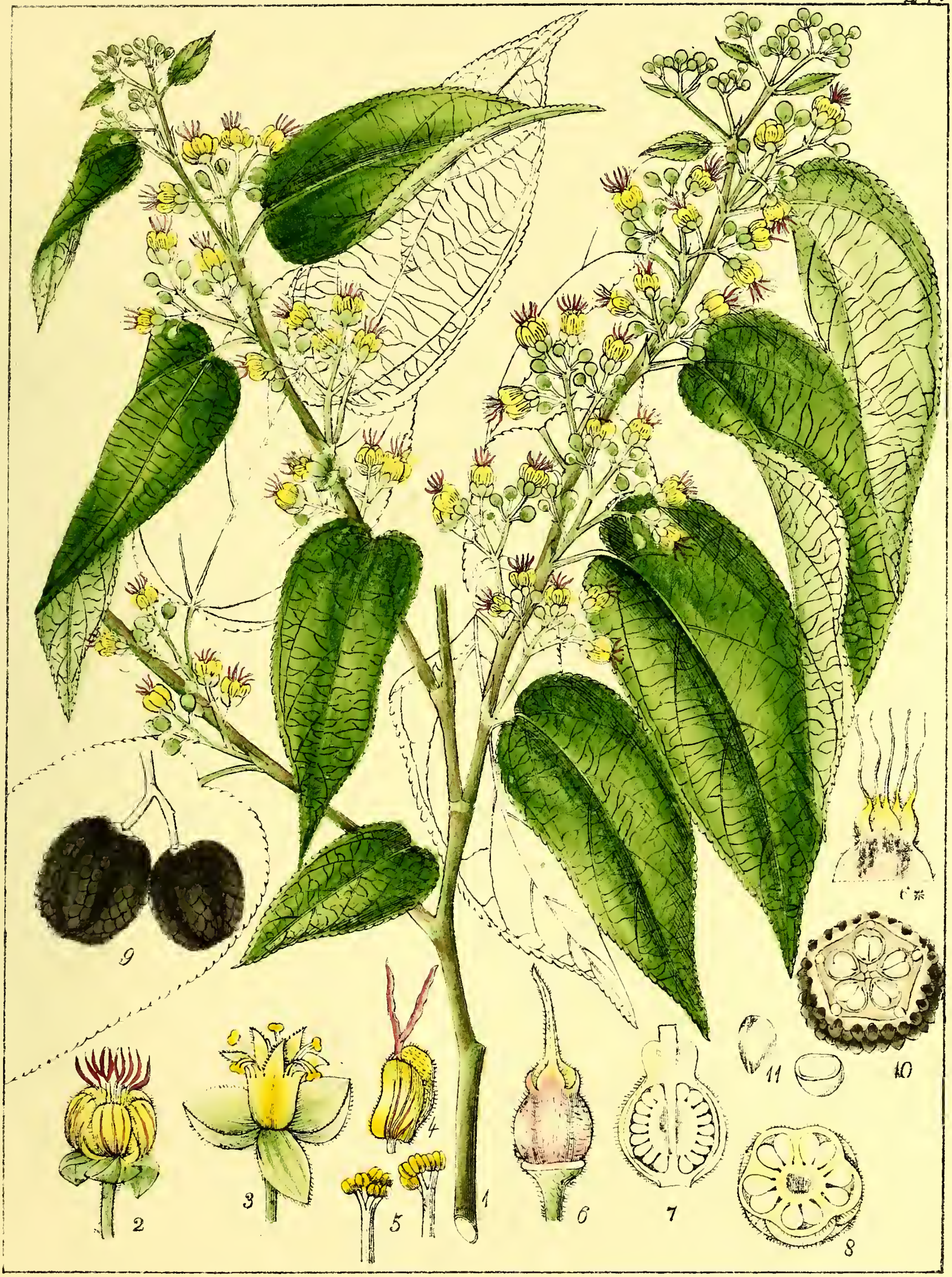
XXV.—HUGONIACEÆ. *Arn.*

This is a very small order, consisting of a single genus, and so far as I am aware of as yet only four species. Dr. Arnott was the first to propose the separation of this genus as the type of a distinct order, and published it as such in our prodromus. Dr. Lindley has since adopted the order in his natural system of Botany, whence we may infer, that he considers it justly separated from those with which it had been previously associated, and indeed there can scarcely be any doubt on the subject, since, for the reasons stated by Dr. Arnott, it could not be associated either with *Malvaceæ* nor *Chlenaceae*.

I republish from the Prodromus Dr. Arnott's character and remarks, the correctness of which I have verified by again carefully comparing them with the plant.

Calyx without an involucel, persistent, 5-sepaled: sepals distinct, acute, unequal: the two exterior lanceolate, densely pubescent on the back; another dimidiate-ovate, the straight side pubescent, the rounded side testaceous and shining; the two inner ones roundish ovate and

STERCULIA BALANGHAS (Linn.)



GUAZUMA TOMENTOSA (H·B·K.)

Rungia del. *Winchester Lith.*

HUGONIA MYSTAX (*Linn.*)

suddenly pointed, testaceous and shining except the short pubescent point : æstivation imbricated, quincuncial. Petals hypogynous, 5, alternate with the sepals, shortly unguiculate : æstivation twisted. Stamens hypogynous, 10, all fertile : filaments united at the base into an urceolus, free and filiform above : anthers cordate-ovate, erect, 2-celled, opening by two longitudinal clefts. Torus slightly elevated, supporting the staminal urceolus and the ovary. Ovarium roundish, coriaceous, glabrous, 5-celled : ovules 2 in each cell, pendulous, collateral. Styles 5, distinct : stigmas slightly dilated and lobed. Fruit (a *nuculanium*) with a fleshy epicarp, enclosing 5 distinct, bony, 1-seeded carpels. Seeds pendulous. Embryo in the axis of fleshy albumen : cotyledons flat, foliaceous : radicle short, superior, pointing to the hilum.—Shrubs. Leaves alternate, or sometimes crowded and opposite near the flowers. Stipules 2, subulate. Peduncles axillary 1-flowered, often by abortion transformed into circinnate spines.

Affinities. The only genus referable here has been placed by De Candolle with doubt in Chlænaceæ, to which we cannot agree ; that order having the calyx and gynœcium in a ternary, while the corolla and andrœcium follow the quinary arrangement. Kunth hesitatingly places it in Byttneriaceæ and the tribe Dombeyaceæ, and there is no doubt that the affinity is very great ; it is now separated on account of the imbricate (not valvate) calyx, the ovules pendulous (not erect or ascending), and the radicle superior (not inferior), rather than invalidate the character of the order by its insertion. In many points it agrees with the character (but not the habit) of Oxalideæ, forming another link between the group of Malvaceous orders, and the Geraniaceæ. Arn.

Geographical Distribution. Of the four known species of the genus Hugonia, one is found in continental India, one in Ceylon, and two in the Mauritius. H. ferruginea though described by us as an Indian plant, I have never seen growing except in Ceylon, and there it appears as a trailing shrub, seeking support from the surrounding jungle.

Properties and Uses. Of these nothing certain is known. Rheede who figures H. mistax, and as usual, gives what information regarding its properties and uses he could collect, informs us that the bruised root is employed to cure inflammation, and against the bites of serpents, that it is also used as a febrifuge, and vermifuge, and that the bark is good against poisons. These statements, which are derived from native information, have not been confirmed by modern experience, at least so far as I have been able to learn.

I have in the course of this work repeatedly alluded to the tendency which some plants have of augmenting or reducing the number of pieces in the floral verticel, and thereby passing from one class to another of the Linnæan system. The accompanying plate presents an example of this change. The quinary order is the normal form of this genus, that is 5 sepals, 5 petals, a 5-celled ovary, and 5 styles and stigmas : but it will be remarked in the fruit cut transversely, that it has only 4 seminiferous cells in place of 5 the regular number. It is probable that each series of floral organs, the calyx, corolla, and stamens was, in that instance, deficient in a similar proportion, namely, one-fifth part.

No additions have been made to this order since the publication of our Prodromus.

EXPLANATION OF PLATE 32.

1. A branch of Hugonia mistax, showing the leaves, flowers and fruit—*natural size*.
2. *Lower figure*—Sepals and petals removed, showing the filaments united at the base into a short tube, *upper one*—the stamens removed to show the extent to which the filaments are united, and that they are alternately longer and shorter.
3. Sepals, ovary, style, and stigmas.
4. A fruit cut transversely, showing four seminiferous cells, and four empty ones alternating. The nuculanum consists of 4 or 5 partially united, 1-celled carpels, or nuts : the alternating cells in this figure are in the lines of separation, and are owing to a depression on the sides of the nuts.

XXVI.—TILIACEÆ.

This order which takes its name from *Tilia*, the Linden or Lime tree, a northern genus, is yet principally of tropical origin, several large genera being found in India, and many

more in equinoctial America. They, like the other members of the class *Columniferae*, are characterized by the valvate œstivation of their calyx, combined with a polypetalous inferior corolla, and inferior stamens, with 2-celled anthers : the leaves are alternate, stipulate, and more or less clothed with stellate pubescence.

In this order trees and shrubs are the predominating forms, but herbaceous plants are also met with, two out of five Indian genera referable to the order being such. The leaves are alternate, simple, petioled, feather-nerved, entire, crenated, toothed or serrated, with two, usually deciduous, stipules. The flowers are bisexual, regular, racemose, or corymbose, occasionally solitary and axillary.

The calyx is 3—5 sepaled, valvate in œstivation, deciduous ; the torus often more or less stipitate : the petals inferior, alternate with the segments of the calyx, and equal to them in number, occasionally supported on a short claw, furnished with a gland or nectarial pit, and imbricated in œstivation, rarely wanting. The stamens are numerous, inferior, sometimes inserted on the apex of the torus, the filaments cohering at the base. The anthers are oval or roundish, 2-celled, opening interiorly by a longitudinal slit. The ovary is usually stipitate, several celled, that is, composed of several united carpels ; the styles are also united into one, but with as many free stigmas as there are carpels in the ovary. The fruit is either capsular or drupacious, several celled, with many or few seeds : the seeds are attached to the central angle, sometimes furnished with an arillus. The albumen is fleshy, the embryo erect, the cotyledons foliaceous, and the radicle inferior or rarely superior.

Affinities. The affinities of this order are the same as the preceding, agreeing with them in their valvate œstivation of the calyx, but distinguished by their free stamens, glandular disk, and appendages at the base of the petals ; the great difference however between the capsular and many seeded pericarps of *Corchorus*, and the drupacious ones of *Grewia*, and some others, seem to indicate a want of uniformity of character in an important organ, unfavourable to this being received as a well constituted order. With this order Kunth and Bartling unite *Elæocarpeae*, a course which has not been followed by other writers, though they are very nearly related, differing principally in the latter, having its petals lacerated or fimbriated on the margins, and the anthers opening by pores.

Geographical Distribution. The species of this order are very widely distributed, extending from the cold and inclement regions of the north, through every degree of latitude, and modification of climate to the extreme south, but the majority are found within the tropics. India according to Wallich's list has 50 species, and several have since been added. Blume describes 21 from Java—and the authors of the Flora Senegambiæ 15 from that portion of Africa. It is remarkable that though both genera and species are frequent in America, Humboldt seems only to have found 16, at least that is all that is characterized in his synopsis. The Indian Peninsula according to our list has 32 species, one of which *Berria Ammonilla* is admitted as doubtful, I have never met with it on the continent, though it abounds in Ceylon. Among the Senegambiam species it is interesting to observe the numerous coincidences existing between them and the Indian forms : four out of 5 species of corchorus, enumerated as natives of that country, are identical with our Indian ones, and the fifth *C. brachycarpus* considered by the authors a new species, I suspect from the character and description to be the same as our *C. fascicularis*. They certainly agree in the peculiarities from which both names are taken, the fascicled flowers and short pods, while the other points of distinction seem too unimportant to admit of much value being attached to them, except that derived from the number of stamens, being 10 in the one, and about 5 in the other, the qualification *about* however, showing that they are not constantly 5 in the Indian form leads to the inference that they may be found equally liable to variation in the African, if many specimens were examined, and by so much reduces the value of a character, otherwise decisive of their dissimilarity. Should actual comparison of specimens prove them distinct, it must at the same time establish their very close affinity.

The genus *Triumfetta* has also its affinities in these very remote countries. *T. trilocularis* is common to both : *T. pentandra* scarcely differs in general appearance from some of our varieties of *T. angulata*, though it does in more important particulars, namely, in the number of its stamens, the cells of its ovary, and the form of its capsules. *Triumfetta cordifolia* has a con-

Rungia del
Winchester Lith

GREWIA MICROCOS (Linn.)

gener, though certainly distinct, in this country, in a yet undescribed species in my herbarium. Of 5 species of *Grewia* found there, one is certainly identical with our *G. villosa*, which being supposed new, by the authors, has received from them the very appropriate name of *G. corylifolia.* The other four species, I am unable to identify, from description only, with any of our species of that most difficult genus. Of the Javanese species several are common to this country, and one or two perhaps to Senegambia, showing, that although limited in their range by latitude, they have a very extensive range of longitude.

Properties and Uses. So much has been said under this head in the preceding orders of the class Columniferæ, which all enjoy analogous properties, that but little is left to be said here. The Tiliaceæ like the other members of that class are mucilaginous and emollient in their properties, and as such, are employed in medicine, in almost every country in which they are found, a few, such as *Corchorus olitorius* are used as pot herbs. But it is in the arts they are most extensively applied. The fibres of the bark of nearly all, are esteemed on account of their strength, and in this country are spun into cordage, or made into cloth. The fabric known in England under the name of Russian mat or *bass*, is made from the inner bark of the Lime tree, *Tilia europaea.* The wood of several kinds is also valuable : the excellent Trincomalee wood of Ceylon, is the produce of *Berria Ammonilla.* The *Grewia elastica*, of Royle, affords timber much valued for its strength and elasticity, and is therefore used for making bows and bandy shafts. A Brazilian species *Lechea paniculata* affords a bark used in tanning leather.

Remarks on Genera &c. The number of genera enumerated as belonging to this order in Lindley's natural system of Botany is 22 certain, and 7 doubtful. Of the first, 5 are found in India and Java, and of the last one *Vatica*, is Indian, and has already been referred, in our Prodromus, to *Dipterocarpeae* as identical with Roxburgh's *Shorea.* The Indian genera are for the most part easily distinguished, *Corchorus* with the exception of *C. capsularis* has elongated many seeded capsules : *Triumfetta* has them somewhat globose, covered with hooked bristles, and few seeds : *Grewia* has baccate or drupacious fruit : and *Berria* winged capsules. *Brownlowia*, a genus of Roxburgh, but most strangely omitted in his flora Indica, is distinguished by its tri-coccous capsules.

The Indian species of these genera are with the exception of *Grewia*, generally of easy discrimination, but some of those of *Grewia*, if really distinct (which I somewhat doubt) are most difficult to distinguish with other than most perfect specimens, the fruit affording the best, if not indeed the only marks by which they can, with certainty, be determined. *G. orientalis* and *G. columnaris*, are so much alike, that I find it almost impossible to say to which I ought to refer many specimens, not in fruit, which have recently been added to my collection. Our *G. emarginata* is very nearly allied to both, but readily distinguished by its globosely lobed fruit. *G. hirsuta* and *G. pilosa* are also so closely allied that it becomes difficult to decide to which, some of the extreme forms of each belong, and leads to the inference that they are but varieties, unless the cleft petals of the latter be found sufficiently constant to keep them distinct *Grewia villosa* of India is certainly identical with *G. corylifolia* of the Flora Senegambiæ, but I cannot perceive that any of the others are, unless perhaps *G. bicolor*, which from description, appears very nearly related to *G. Rothii*, except in the fruit which is stated to be globose in the one, and 2-lobed or dydimous in the other, apparently an excellent distinction. As this is a very difficult family, I propose shortly publishing figures in my Icones, of a number of them.

EXPLANATION OF PLATE 33.

1. Flowering branch of Grewia Microcos—*natural size.*
2. A flower, the sepals drawn back to show the petals and stamens.
3. The same, sepals and petals removed, showing the elevated torus, and the attachment of the stamens round the ovary—the upper figure a detached petal, showing its glandular appendage at the base, surrounded by a fringe of short hairs.
4. Stamens back and front views.
5. Ovary cut vertically.
6. The same cut transversely.
7. Full grown fruit cut transversely—*all more or less magnified.*
8. A mature fruit—*natural size.*

EXPLANATION OF PLATE 34.

1. Flowering branch of Berria Ammonilla—*natural size.*
2. A flower closed showing the relative size of the sepals and petals, and that the former are partly united at the base.
3. The same forcibly expanded.
4. Ovary and sepals partially removed, showing the relative situation of all the parts of the flower.
5. An anther.
6. The ovary cut vertically, showing ovules pendulous in the cells.
7. The same cut transversely.
8. A full grown fruit.
9. The same cut transversely, showing by the presence of the full number of wings, that in this instance, one of the cells of the ovary has aborted in the course of its progress towards maturity.
10. One of the valves of the capsule removed, showing by the partition in the centre between the seeds, that the dehiscence is loculicidal.
11. A seed.
12. The same cut vertically.

XXVII.—ELÆOCARPEÆ.

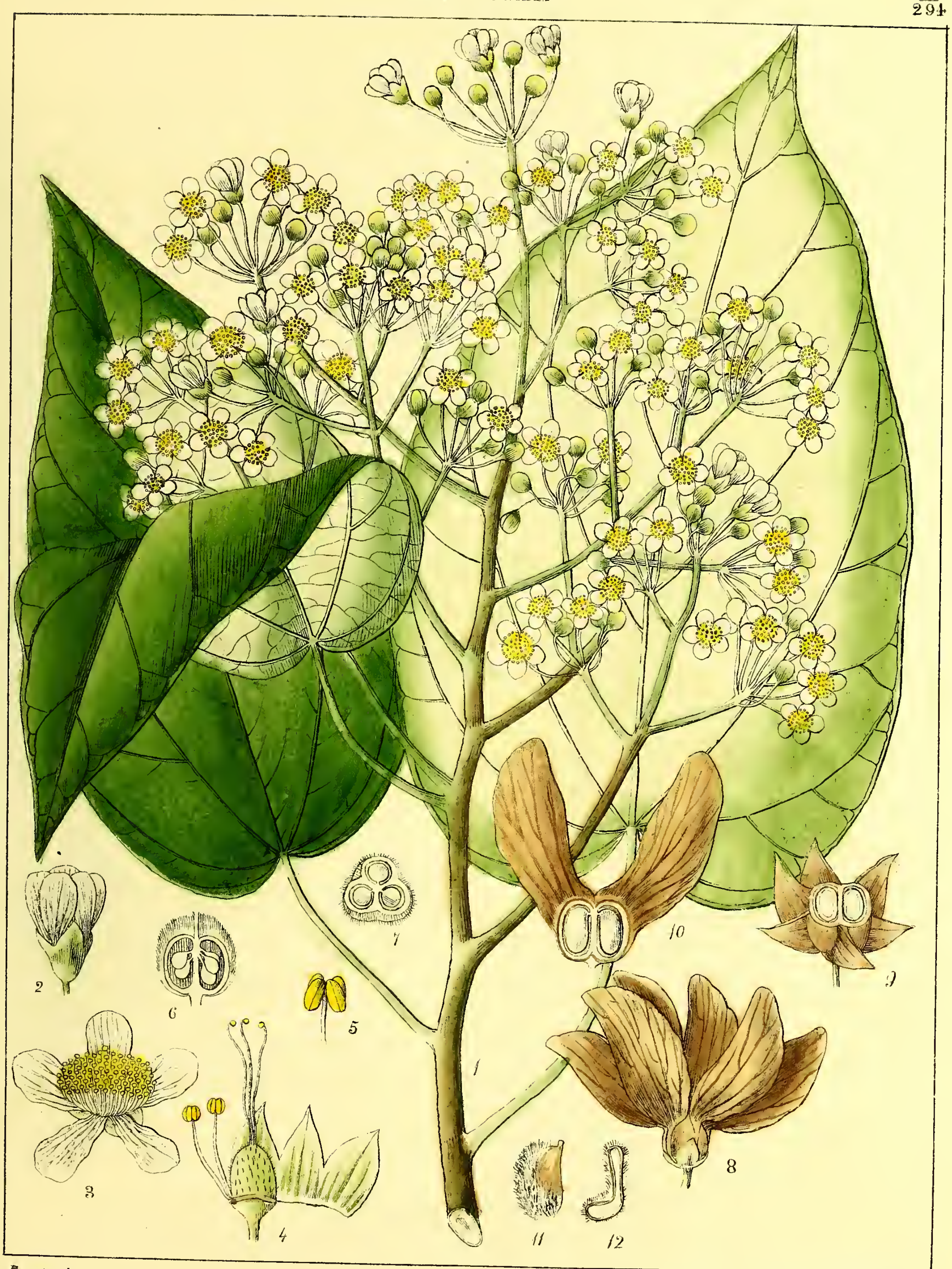
A small order of plants and principally of Indian origin, 10 out of about 20 described species, being natives of this country. The species are either handsome trees, or shrubs, with alternate, stipulate leaves, the stipules usually early deciduous, racemose flowers, and divided fimbriated petals.

Sepals 4 or 5 without an involucrum, the œstivation valvate. Petals 4 or 5 hypogynous, rarely wanting, lobed or fringed at the point, œstivation imperfectly imbricated or sometimes valvate. Disk glandular, somewhat projecting. Stamens hypogynous or rarely perigynous, some multiple of the sepals, (8—80) filaments short, distinct, or slightly united at the base, anthers long, opening at the apex by a double pore. Ovary with two or more cells: style solitary, simple, or sometimes trifid, rarely several: stigmas either free, equalling the cells of the ovary, or united. Fruit variable, indehiscent, dry, drupacious, or valvular and loculicidal; sometimes by abortion 1-celled. Seeds one or two in each cell. Albumen fleshy. Embryo inverted. Cotyledons flat, foliaceous, radicle superior.

Affinities. As this order only differs from *Tiliaceæ* in its fringed petals, and the elongated anthers opening at the apex by pores, in place of the cells splitting their whole length, it is of course more nearly allied to that order than any other, and has been, apparently not unjustly, referred to it by Kunth, no mean authority, whose opinion has been adopted by Bartling. Such being the case, whatever may be the affinities of the one order are equally those of the other, and therefore, I refer to *Tiliaceæ* for any further information that may be wanted on this head.

Geographical Distribution. India and her islands seem to be the head quarters of this order, the species of which we find very generally distributed over the sub-alpine regions of the country, though not confined to them. Dr. Wallich in his list of Indian plants enumerates no fewer than 28 species, not however all continental. Dr. Roxburgh gives descriptions of 9 species, and Blume in his flora of Java of 11. These last however are not all distinct from those named by Wallich. Only five or six species have yet, so far as I am aware, been found in the Peninsula and Ceylon. In addition to these Indian ones, a few are found in Australia and South America, whence it would appear, that in proportion to the number of species, few orders are spread over a more extensive surface than the *Elæocarpeæ*.

Properties and Uses. Respecting these, if they possess any, little is known, Dr. Horsfield mentions that the bark of one species is very bitter, and is used in Java as an anthelminthic. The olive-like fruit of *El. serratus* is dried by the natives and used in curries, and also pickled, Dr. Roxburgh tried in vain to extract oil from the seeds. The nuts of *Monocera*, as well as those of some of the *Elæocarpi*, are polished and set in gold as beads; in which state they are esteemed sacred by some casts of the Hindoos. They are of a dark brown colour, very hard, tuberculated on the surface, and are readily known by their splitting into two or three pieces, the number of carpels namely, that unite to form the perfect fruit.



Rungia del.

BERRYA AMMONILLA. (*Roxb.*)

Winchester. Lith.

REMARKS ON GENERA AND SPECIES. The characters, of both the genera and species of this order, seem involved in much doubt and uncertainty, and with my imperfect materials, I fear, I shall not be able to throw much light on the subject, or to supply what is wanting to place either on a better footing than that on which they now stand. The uncertainty appertaining to the genera, seems in part to have arisen from DeCandolle having taken his character of *Elæocarpus*, from a species which did not belong to the genus, as defined by Linnæus, and then characterizing a genuine *Elæocarpus* under a new name, *Aceratum*, still retaining however several true Elæocarpi, congeners of his Aceratum, under his modified *Elæocarpus*, though a quite distinct genus. From the confusion thus introduced Dr. Jack's genus *Monocera* has happily relieved us. The leading peculiarities of Linnæus' *Elæocarpus* consists in its having 5 sepals, 5 fimbriated petals, numerous stamens, the anthers 2-valved at the apex, *not awned*, to which was afterwards added a 3-celled ovary. Of this series of distinctive marks, the only ones not common to *Monocera* are,—the truncated 2-valved anthers, and the 3-celled ovaries—these therefore form the essential characters of the genus which may be thus defined, ' stamens numerous, anthers 2-valved at the apex, valves equal, muticous, sometimes bearded, ovary 3-celled.' *Monocera* on the other hand has the anthers terminating in a bristle or awn, and a 2-celled ovary. *Elæocarpus ganitrus* having a 5-celled ovary, and anthers without bristles, has been made the type of a new genus under the name of *Ganitrus*. Blume proposes as a fourth genus *Acronodia* distinguished by having unisexual flowers, quaternary sepals and petals, and 8—12 stamens, destitute of terminal bristles. Adopting these generic distinctions Roxburgh's 9 species *of Elæocarpus* may be thus distributed.

Ganitrus—Anthers muticous, ovary 5-celled.

G. Roxburgii—Elæocarpus Ganitrus—R.

Elæocarpus. Anthers muticous, often bearded at the apex, ovary 3-celled.

E. serratus. E. robustus. E. lancæfolius. E. frutescens.

Monocera—Anthers furnished with a bristle, ovary 2-celled.

M. tuberculata. E. tuberculatus. R.—*M. rugosa.* E. rugosus. R.—*M. Roxburgii* (R. W.) E. aristatus. R.—To these may be added a species, I think new, from Mergui, collected by Mr. Griffith: *M. Griffithii* R. W. one from Ceylon, *M. glandulifera* R. W. and one from Coorg. *M. Muroii.* R. W.

Species not sufficiently known.

Elæocarpus lucidus—Roxb.

Of the 22 species enumerated in Dr. Wallich's list I can give no account, as we have names only: neither can I refer any of Blume's species to other genera than the one he has assigned, as he neither gives a generic character, nor once mentions, in his specific ones, (which are all taken from the forms of the foliage, relative length of the racemes and leaves, and form of the fruit) the stamens or ovaries. The whole of his species therefore, 11 in number, require to be re-examined. The new Zealand genus *Dicera* is only distinguished from *Monocera* by the anthers having two, in place of one bristle, whence the name, a species of which is said to be a native of Cochin-China, but is very imperfectly known.

Thus simplified in their generic distribution and greatly reduced in number, the species of *Elæocarpus*, hitherto most difficult to define, may henceforth be more easily distinguished, an operation which will be still further facilitated by subdividing what remains into two sections, one with, the other without, bearded anthers. To the first of these sections belong—Roxburgh's *E. serratus, E. robustus, E. lancifolius,* and *E. fruticosus*, and lastly, one from Quilon, *E. cuniatus*, R. W. To the other *E. oblongus, E. coriaceus* Hooker, E. serratus? Moon, and one from Mergui, *E. angustifolius?* Blume.

As my materials do not extend to the other genera of the order I can offer no remarks regarding them; but the following characters will, I hope, prove sufficient to distinguish the new species named above.

ELÆOCARPUS.

Sect. 1. Anthers bearded.

E. cuniatus, R. W. Leaves cuneate obovate, terminating in a short obtuse acumen, tapering below into the petiol: Stamens numerous, bearded, hairs at length reflexed: Ovary 3-celled, elevated on a prominent torus, and with it, thickly clothed with appressed white hairs.

Malabar Coast about Quilon, also in Ceylon.

This species is nearly allied to *E. oblongus* except in having bearded anthers and an elevated torus, in place of being beardless, with the ovary sessile and surrounded by a number of glands, the more usual structure of the genus.

Sect. 2. Anthers beardless.

E. coriaceus (Hooker in Herb. Walker). Leaves

coriaceous, glabrous, very obtuse above, somewhat cuniate downwards, slightly serrated on the margin, occasionally somewhat cordate at the base; glands in the axils of the veins: racemes axillary; flowers drooping; sepals lanceolate, tomentose: anthers beardless: ovary surrounded by glands: fruit globose.

E. obovatus, Arnott not Don.

Neuera Ellia, Ceylon—Colonel Walker.

This species which I have only seen from Ceylon was found by Colonel Walker in the most elevated parts of the island, and named by Sir W. J. Hooker, from specimens sent to him. It was also named and described by Dr. Arnott in his Pugillus Plantarum &c., but as his name was pre-occupied I have adopted the manuscript name of Sir W. J. Hooker.

E. angustifolius? Blume. Leaves long petioled, oval-oblong, acuminated, remotely crenato, serrated, without glands on the under surface: racemes axillary, about twice the length of the petiols: flowers rather small, glabrous: anthers beardless: ovary, surrounded at the base by 10 globose hairy glands.

Mergui—communicated by W. Griffith, Esq.

This species, which corresponds with Blume's character so far as it goes, but differs as to the native country, is very like our E. oblongus, and is I suspect but a variety of that species. It is much to be regretted that Blume's characters are so brief, and that he does not make use of marks derived from the parts of the flower in his specific characters, as I have always found these most to be depended upon.

In addition to the preceding, I have a species referable to this section, but the specimen being somewhat imperfect, prevents me determining with certainty whether or not it is described, neither do I know its native country. The flowers correspond so exactly in appearance with *Monocera tuberculata* that for a long time I believed it that plant. Should it prove new I would propose the name *Monoceroides.*

E. monoceroides, leaves elliptic, glabrous, racemes lax few flowered, flowers drooping: Stamens numerous, glabrous, anthers somewhat pointed, beardless shorter than the style.

MONOCERA.

M. glandulifera. (Hooker MSS. in Herb. Walker.) Leaves ovate, lanceolate, or somewhat undulated on the margin, crenately serrated, glabrous, with numerous saccate glands in the axils of the veins on the under surface: racemes axillary, shorter than the leaves: flowers numerous, short pediceled, drooping: petals pubescent; anthers hairy: fruit oval.

Ceylon.—This seems a very distinct species, though nearly allied to the next from the same country.

M. Walkerii R. W. Glabrous, except the petals, leaves broadly ovate, acuminate, entire, or very slightly crenated and revolute on the margin, glaucous beneath, not furnished with glands: racemes axillary, equalling the leaves: flowers long pedicelled drooping, petals obtuse, cuniate, sparingly fimbriated, densely clothed on the back with appressed white hair: a ring of glands surrounding the base of the ovary.

Ceylon.—Colonel Walker.

The only specimen I have seen is in Col. Walker's herbarium, marked, "*Elæocarpus pubescens* Hooker," but as it is every where glabrous except the petals, and as all the species partake more or less of that character, I fear some mistake in the naming; the more so, as there is a Ceylon species of Elæocarpus with pubescent leaves. On these grounds I have ventured to change the name. It seems closely allied to *M. Ceylanica,* Arnott, but in his plant the racemes spring from below the leaves "racemis infra folia hornotina ortis" while in this they are above, in his the petals are sparingly pubescent on the back, in this they are very thickly clothed with appressed hairs.

M. Griffithii (R. W.) Arborious, glabrous, branches smooth, leaves ovate, lanceolate, acuminate, shining above, pale beneath; racemes axillary, longer than the leaves, many flowered: pedicels equalling the petiols: petals lanceolate acute, slightly 3-toothed at the apex, involute on the margin, hence æstivation valvate, hairy on both sides: Stamens numerous; anthers hairy, bristle reflex hooked: Ovary, with 5 small, somewhat 2-lobed, glands at the base, 2-celled: fruit.

Mergui.—Griffith.

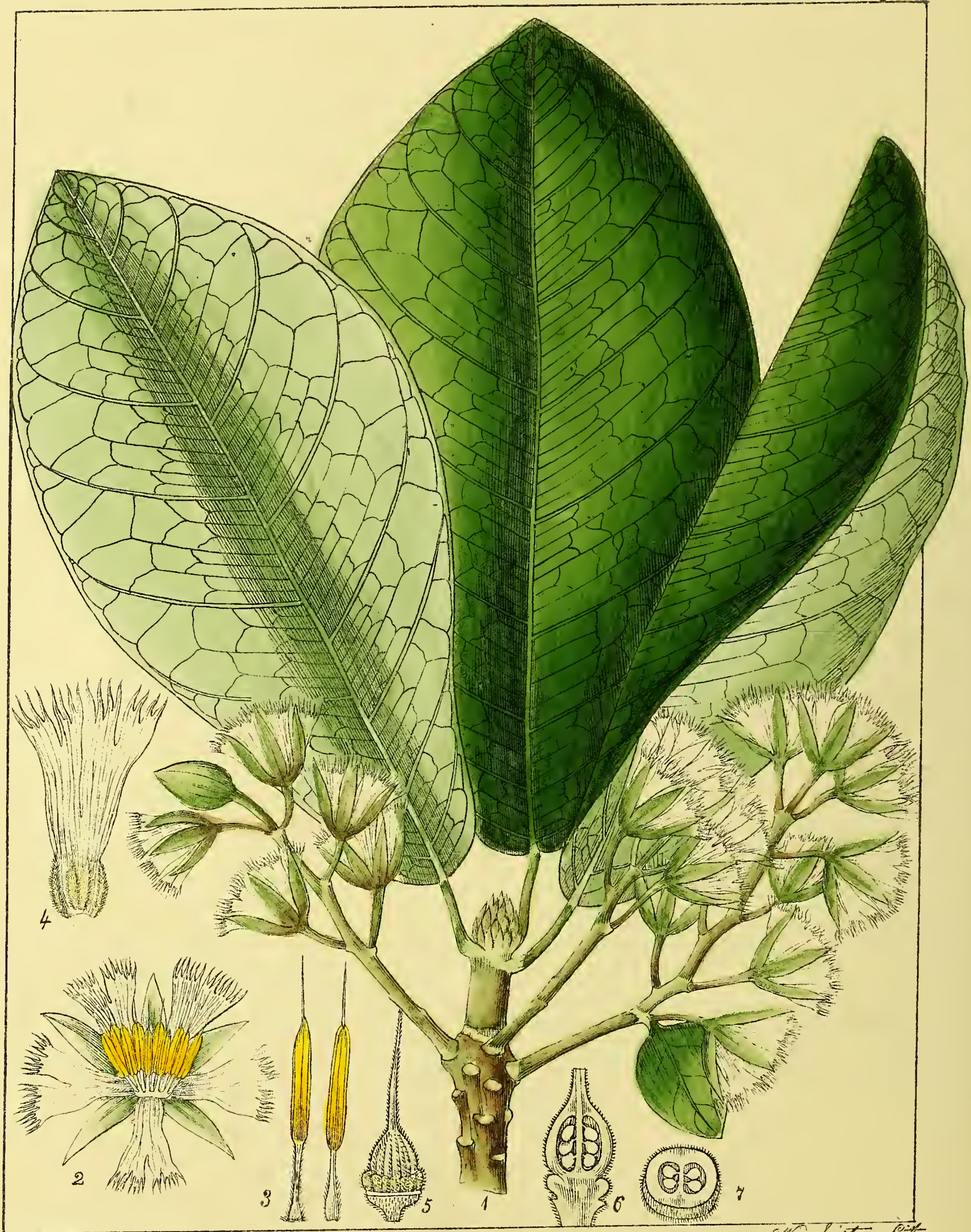
My specimens of this very distinct species were kindly communicated by W. Griffith, Esq. along with a large collection of plants from that as yet little explored coast, among which I have, in the course of a slight examination, observed numerous very interesting and little known species, of which I trust Mr. G. will ere long find leisure to give some account.

M. Munroii.—R. W. Glabrous, leaves ovate-lanceolate, acuminated, slightly crenated on the margin without glands on the under surface: racemes about the length of the leaves, many flowered; flowers drooping: sepals lanceolate acute: petals not involute on the margins: anthers glabrous, bristles at length reflexed: ovary elevated on the torus, very hairy, fruit about the size of an olive.

Coorg.—Lieutenant Munro.

Mr. Munro remarks in a note which accompanied the specimens "This is a large tree common in Coorg. The fruit is eaten by the Natives.

This species is most nearly allied to M. *glandulifera,* but differs in the leaves being totally destitute of glands.



Rungia del

Winchester Lith

MONOCERA TUBERCULATA (W. & A.)

EXPLANATION OF PLATE 35.

1. Flowering branch of Monocera tuberculata—*natural size.*
2. A flower forcibly opened, showing the filaments slightly united at the base.
3. Back and front views of the anthers.
4. A detached petal.
5. The ovary surrounded at the base by a ring of glands.
6 and 7. The same cut vertically and transversely.

XXVIII.—DIPTEROCARPEÆ.

A small but, to Indian Botanists, highly interesting order being nearly confined to India and her islands. Two species only are noted as of foreign (African) origin. It is principally composed of large, handsome, fine flowering, trees, abounding in resinous juice. The leaves are alternate, marked with strong parallel veins, running from the midrib to the margin, furnished with deciduous, convolute, stipules, terminating the branches in a point: the racemes, of flowers are either terminal and panicled, or axillary, solitary, or several from the same leaves or from the axils, the flowers often secund.

Calyx persistent, somewhat tubular at the base, 5-lobed, lobes at first slightly unequal, afterwards enlarged, usually two of them much more so than the rest, becoming wing-like, æstivation imbricated. Petals hypogynous free, or slightly combined at the base; æstivation twisted. Stamens indefinite, distinct, when numerous, attached to a broad somewhat elevated torus, occasionally irregularly polyadelphous; when few, adherent to the base of the petals: filaments dilated at the base: anthers frequently terminating in bristle, or tipped with a gland-like point, 2-celled, opening by terminal fissures. Ovary few (3) celled, with two pendulous ovules in each: Style and stigma simple. Fruit coriaceous, 1-celled, by abortion, 3-valved or indehiscent, surrounded by the calyx. Seed solitary, without albumen. Cotyledons twisted or crumpled, or unequal, and obliquely incumbent, radicle superior.

Affinities. In its affinities this order certainly claims close relationship with the *Elaeocarpeae*, but is yet perfectly distinct, the imbricate æstivation of the calyx, and the spirally contorted one of the corolla, affording ample grounds for their separation, notwithstanding the great similarity that exists between the stamens and pistils. The spiral æstivation of the corolla and crumpled cotyledons associate it with Malvaceæ, but the usually elongated 2 celled anthers, pendulous ovules, and imbricate œstivation of the calyx of *Dipterocarpeae*, keep them sufficiently distinct. With *Guttiferae* this order agrees in many points, more especially in its resinous juice, and exalbuminous seed, but is at once distinguished by its stipules, alternate leaves, and the very different æstivation of its corolla. "The enlarged foliaceous unequal segments of the calyx while investing the fruit, point out this family at once" (Lindley) and not less certainly, the inflorescence when in flower.

Geographical Distribution. The species of this order though few in number are yet spread over every part of India and her islands, from Ceylon and the southern promontory of the Peninsula, they extend northwards nearly to the foot of the Himalayas: and from the coast of Malabar, eastward, through Burmah, Siam, and Cochin-China, to Java. Roxburgh's catalogue of this order is very full, containing no fewer than 16 species, while Dr. Wallich's has only 19, several of these however were unknown to Roxburgh: whence, I presume, we may assume the number of Indian ones to amount to about 25 species. Blume has 4 from Java, but whether any of these are identical with any of the Indian species, I am not prepared to say, and to determine which, would require a more careful examination than I have the means of giving them. The genus *Lophira* having two species, both from Sierra Leone, is referred to this order. These are the only species, not of Asiatic origin, belonging to this family. In this neighbourhood (Madras) several species are found, but all natives of the hilly tracts forming the Balaghaut. In Silhet, Chittagong, and Pegue, where they abound, they occupy the plains. In Java three, of the 4 species described, are natives of mountain forests, the 4th is found on the sea-shore, and hence has been by Blume called *Dipterocarpus littoralis*. A *Hopea* and *Vateria India* equally approach the coast in Malabar, but the latter is probably not confined to it, since either it, or one

very like, is found in Mysore. Two or three species are found in Goomsoor forming extensive forests, and affording to the inhabitants Incense, Dammer, and Wood oil. The imperfect descriptions of Dr Maxwell and Captain McPherson, (Madras Journal of Science Nos. 18 and 19) to whom we are indebted for this information, does not enable me to determine the species, nor with certainty the genera, but judging from imperfect specimens collected by the former of these gentlemen, one of them belongs to Roxburgh's genus *Shorea,* apparently his *S. robusta,* what the others may be, I am unable to form even a conjecture.

Both the authors mention *Chloroxylon Dupada* as being one of them, but this I think must be a mistake, originating in a statement of Dr. Ainslie, that that is the botanical name given to the Indian Dammer tree by Dr. Buchanan, but which, was an error of his, arising from his not being aware that several trees produce Dammer and that his *Chloroxylon Dupada* was already described by Linnæus under the generic name of *Vateria.* The specimens sent unquestionably do not, belong to that genus, but as the inflorescence is in a very young state and there is no fruit, I do venture to say what they are, though I suspect them to be Roxburgh's *Shorea robusta.* From Ceylon the only ones I have seen are a species of *Dipterocarpus (D. turbinatus)* and a new species of *Vateria.*

Properties and Uses. These are various and important. Almost every species of the order abounds in balsamic resinous juice, in very general use in every part of India, and well known to Europeans under the common English names of Dammer, and Wood oil, according as it hardens or remains fluid on exposure to the air. That drawn from the *Shoreas* or *Vaticas* and *Vaterias* hardens and forms Dammer, and Piney, that from *Dipterocarpi* retains its fluidity, and is the Wood oil, of the bazaars. Some of the species produce a fragrant resin, which is burnt in the temples as Incense. Dammer is used in India for most of the purposes to which pitch and rosen are applied in Europe. Wood oil either alone, or thickened with dammer, supplies a common, but useful, varnish for wood, possessing the valuable property of, for a long time, repelling the attacks of white ants, as well as of resisting the influence of the climate. The Camphor tree of Sumatra is a species of *Vatica,* (*Shorea camphorifera,* Roxb.) and produces the finest camphor. A variety of other trees are said to afford this curious substance, but none equal to this, either in quality or quantity. The *Vateria Indica* (*Chloroxylon Dupada,* Buchanan and Ainslie, and Pinne marum of the Hindoos) produces a resin, resembling Copal, much finer than that procured from the other species natives of India, the finer specimens of which are as transparent as amber, and nearly colorless. It is procured by the very simple process of cutting a notch in the tree, sloping inwards and downwards. This is soon filled with the juice, which in a short time hardens by exposure to the air. When used as a varnish the usual practice is to apply the balsam before it has become hard : but when that is not procurable the resin melted by a slow heat and mixed with boiling Linseed oil forms a varnish which answers equally well for most purposes.

As this varnish is of the finest description the following formula for its preparation may prove useful to some who are unacquainted with the process. Into a new and perfectly clean earthen vessel (a chatty) put one part of the Piney dammer, in coarse powder cover closely, and apply a *very gentle* heat until the whole is melted ; then add about two parts of linseed oil, nearly boiling hot, and mix well with a wooden spathula. Should the varnish prove too thick it can at any time be reduced by the addition of more oil, or if required may be made thicker in the first instance.

It is essential to the success of the process that the Piney be melted in a covered vessel over a very slow fire, and the whole of it reduced to a fluid before the addition of the oil, which must, to ensure an equal mixture, be nearly boiling hot. This varnish is used for carriages and other fine furniture requiring to have their paint well protected, or to which it is desirable to impart a fine gloss.

A spirit varnish is prepared by reducing to powder about six parts of Piney and one of Camphor, and then adding hot alcohol sufficient to dissolve the mixed powder. Alcohol does not dissolve Piney without the aid of the Camphor, but once dissolved will retain it in solution.

The varnish thus prepared is employed for varnishing pictures, &c., but before being used requires to be gently heated to evaporate the Camphor, which otherwise will produce by its after evaporation a roughness and inequality on the surface of the picture, and spoil its appearance.

In addition to these more common applications of Piney, it is, on the Malabar coast, made into candles. These diffuse, in burning, an agreeable fragrance, give a fine clear light, with

little smoke, and consume the wick so as not to require snuffing. For making them the fluid resin may either be run into moulds, or when yet soft and pliable, in course of hardening, be rolled into the required shape. Some of these candles that were sent home, were highly prized, and sold for very high prices, but the protective duties on made candles, imported into Britain, is so high, as to amount to a prohibition, and put a stop to this trade. The crude Piney is however still sent for the purpose of being manufactured at home.

The medicinal properties of Camphor are too well known to require notice here, and those of Dammer are as yet but little known. The late Dr. Herklots directed attention to a native remedy for Berriberri Chloroxylon, black or Liniment the basis of which is Dammer, and gave a formula for its preparation, which has been published by Mr. Malcolmson page 328 of his essay on Berriberri. Both these gentlemen recommend it as a useful auxillary in the treatment of this most fatal disease. Of its merits, I am unable to speak from personal knowledge, as I have never seen it used, nor indeed have ever seen the medicine, but Mr. Malcolmson seems to think it preferable to the liniments in general use, among us, for most cases requiring that kind of stimulus.

As nearly all the plants belonging to this order are trees, among the most majestic of the forest, they are esteemed for their timber, as well as for their resinous juice, and the well-known Saul, *Shorea robusta* Roxb. is considered by that eminent naturalist as only second to Teak, for most purposes requiring a strong durable wood. As ornamental trees they merit much attention, not only on account of their majestic size and handsome forms, but equally for the beauty of their clustered flowers, and the richly colored wings of their curious fruit. Both the Hopea, and Vatica Tumbugia (see Icones) are found in the vicinity of Madras, and might, I presume, be easily introduced into our gardens, where I have no doubt they would be much admired. Whether the Piney from Malabar would equally succeed is doubtful, but it is well deserving of a trial, since it is scarcely exceeded in beauty by any other tree.

Remarks on the Genera and Species. The genera of this order are few in number, and generally agree so nearly in their distinctive characters that one is almost led to doubt whether they ought all to be retained. Dr. Lindley enumerates five, four of which are Indian. These may be thus distinguished. In Vateria, all the sepals more or less enlarge with the fruit, but do not form membranous wing-like appendages. In *Hopea* and *Dipterocarpus*, two of the sepals enlarge, and become dry scariose wings: the former is further distinguished by having 10 compressed filaments adhering to the base of the corolla and 15 short anthers, each alternate filament bearing two anthers, to which may be added as supplementary characters, the nearly sessile secund small flowers, greatly twisted æstivation, and union, at the base, of the petals: the latter, by having fewer and larger flowers, slightly twisted æstivation, and numerous filaments, each bearing a single elongated anther. In *Vatica* Lin. (Shorea of Roxb. and others) all the sepals, more or less enlarge, and become wing-shaped; the stamens vary much in number, but are generally numerous. Dr. Arnott and I remark (W. and A. Prod.) that *Vateria lanceæfolia* Roxb. "ought perhaps to form a distinct genus," since then I have received specimens of a very nearly allied species (*V. Roxburgii* R. W. Icones, No. 26) a native of the Peninsula. From an examination of this plant I still feel disposed to adopt the opinion then expressed, as there are points of difference, I think, of sufficient weight to separate them, but on the other hand a slight modification of the generic character suffices to keep them together, and as they essentially agree in the character of the calyx, both when in flower and in fruit, and that being the organ from which the generic distinctions of the order are principallly derived, I prefer leaving them in the genus, but forming for their more easy accommodation a subgenus; a plan, in which I was happy to find myself anticipated by Dr Arnott, from whom, I received while this was passing through the press, a synopsis of the genus so arranged. *V. ceylanica* which I have added is exactly intermediate between his two subgenera, having the elongated style and acute stigma of the one, and the stamens and axillary inflorescence of the other. The fruit I have not seen, and the flowers not being full blown in the only specimen I have examined, it is too imperfect to enable me to determine the point, but I think it probable the species will, when better known, form the type of a third subgenus.

I mentioned above that *Vateria indica* was probably a native of Mysore. This opinion rests on some well executed drawings and specimens communicated by Mr. Apothecary Bertie*

* I am indebted to Bertie for several very well executed drawings of plants and trust that my expectations of receiving many more will not be disappointed. An accomplishment so rare among the members of his branch of the service merits public commendation.

under the name of Dhupada Mara. The specimens are not in flower, and the representation of the flowers is not accompanied with such details and analysis as to enable me to say, with certainty, whether the Mysore and Malabar trees are the same or distinct species, there are differences in the form of the leaves that give rise to a suspicion that they are different, but these I do not think sufficient to establish the point. This I presume is the true *Chloroxylon dupada* of Buchanan, a really good figure of which it is most desirable should be published, even at the risk of republishing in outline, what has been already published as a coloured plate. Under this impression, I trust the same liberal hand which has enabled me so far to verify the tree meant by Buchanan (afterward Hamilton) as the Dammer tree of India, will enable me to do the rest by finally determining the species. This seems much wanted, since, in the present imperfect state of our knowledge, every plant of this part of India from which a concrete resinous juice is procured, and these are many, is at once designated *Chloroxylon dupada* from that circumstance alone.

My suspicions of the Mysore species being different from the Malabar one, are strengthened by the circumstance of a species, quite distinct from V. indica, but very closely resembling, in general appearance, the Mysore form, being found in Ceylon. The difference between the Ceylon and Malabar plants lies in the stamens, and cannot be seen without careful examination, those of the Ceylon species (*V. Ceylanica*, R. W.) being few, (15) sessile, tomentose, with a very short almost imperceptible prolongation of the point; while in V. indica, they are very numerous, supported on a distinct filament, glabrous, and terminating in a long slender bristle point. There are besides differences in the leaves, but these I consider of less value as a specific distinctions than the peculiarities of the flowers.

Among a collection of plants from Mergui, for which I am indebted to my friend Mr. Griffith, I observe specimens of some new species of this order, but which I do not consider myself at liberty to name or describe, as I presume it is his intention to publish descriptions of the whole of his now vast collections, amounting, I understand, to between 7000 and 8000 species. The species of *Hopea* are as yet few, but will, I think, be found more numerous when the characters are better understood, at least my specimens, which are numerous, present such variations of form, as renders it probable, there are more than one species, but as yet, I am unable to disentangle them. The dissected flower of the accompanying figure, if correct, seems to indicate that the plant figured is distinct from all those in my collection, in having only 10 anthers in place of 15, the usual number; namely, 5 simple filaments, with single anthers, and 5 cleft ones, each bearing two anthers. There is a species in Mysore which Dr. Buchanan Hamilton has named *H. decandra*, but of which he has given no description: this may be that plant, but I rather think the deficiency is referable to an error or oversight of the artist, and which was not detected in time to prevent its being printed. In addition to the Peninsular ones there are two from Mergui, but none have yet reached me from Ceylon.

VATERIA.

Subgenus I. Euvateria (*Arn.*) Segments of the calyx scarcely enlarging when in fruit, obtuse. Petals oval, scarcely longer than the calyx. Stamens 40—50 anther cells linear. Style elongated, stigma acute. *Panicle large terminal.*

1. *V. Indica.* Lin.

Subgenus II. Isauxis (*Arn.*) Segments of the calyx enlarging when in fruit, ovate, acute. Petals falcate about three times the length of the calyx. Stamens 15, anther cells oblong. Style short. Stigma clavate 3—6 toothed. *Panicles axillary shorter than the leaves.*

2. *V. lanceæfolia.* Roxb. Leaves lanceolate, acute at the base.

3. V. Roxburghiana R. W. Leaves ovate, oblong, retuse, or obtuse at the base.

? 4. *V. Ceylanica* R. W. Leaves obovate, very obtuse, retuse at the point, narrow at the base: anthers hairy, stigma acute.

EXPLANATION OF PLATE 36.

1. Flowering branch of Vateria Indica—*natural size.*
2. Calyx, corolla and anthers.
3. Ovary, style, and stigma, with two stamens left to show their hypogynous insertion.
4. A branch of the panicle in fruit.
5. A fruit cut transversely, showing the irregular form of the cotyledons—*all more or less magnified.*

Rungia del *Winchester Lith*

VATERIA INDICA (*Linn*.:)

Kungia del. Winchisler. lith.

HOPEA WIGHTIANA (*Wall.*)

EXPLANATION OF PLATE 37.

1. Flowering branch of Hopea Wightiana---*natural size*.
2. Ovary and sepals.
3. Corolla and stamens: the latter perhaps incorrectly represented—see remarks page 38.
4. A detached stamen.
5. Ovary cut transversely.
6. A fruit showing the wing-like enlargement of the sepals.
7. A seed cut transversely.
8 and 9. The testa removed, showing irregular forms of the cotyledons and superior radicle.
10, 11, 12. Sections of the fungus-like excrescence on the branch, which seem to indicate that it is an abortive panicle, perhaps rendered so, through insects forming their nidus in the bud.

XXIX.—TERNSTRÆMIACEÆ.

This is a small order, and, but for containing the tea plant, one of very inferior importance. The possession of that one species however, raises it to the first rank in the estimation of mankind. Most of the species, are fine flowering trees or shrubs, with alternate, coriaceous, entire, or serrated, exstipulate leaves, occasionally furnished with pellucid dots: axillary, solitary, or fascicled, bisexual flowers, sometimes collected into terminal racemes.

Calyx persistent, often surrounded with bracteæ, 3—5 sepaled; sepals unequal, coriaceous, obtuse, imbricated in æstivation, the innermost often the largest. Petals varying in number — 5-6-9,—and not equal in number to the sepals, often combined at the base. Stamens hypogynous, numerous, often adhering at the base to the petals, or monadelphous, or polyadelphous. Ovary superior with several cells, and several, usually, pendulous ovules in each; styles 2—7, distinct, or more or less combined. Fruit 2—7 celled, coriaceous and indehiscent, or capsular, and opening by valves. Seeds few, often large, sometimes furnished with a membranous wing, exalbuminous: radicle turned towards the hilum: cotyledons often large, oblong, sometimes longitudinally plaited; when winged small and compressed; often containing oil.

Affinities. These have only recently been sufficiently understood, through the labours of Cambessedes, who, in 1828, published a memoir on the order. To that work I have not the means of referring, and shall therefore avail myself of the abridgement, of the part bearing on this section, given in Dr. Lindley's excellent natural system of Botany, by quoting the whole of his paragraph on the subject of affinities.

"This order originated in 1813, with Mirbel, who separated some of its genera from Aurantiaceæ, where they had been placed by Jussieu, and at the same time founded another closely allied order, under the name of Theaceæ. These opinions were substantially adopted by Kunth and DeCandolle, the latter of whom, moreover, formed several sections among his Ternströmiaceæ. It is, however, certain, that no solid difference exists between this last order and Theaceæ or Camellieæ, as they were called by DeCandolle; and Cambessedes, after a careful revision of the whole, has come to the conclusion, that even the sections proposed by DeCandolle among Ternströmiaceæ are untenable. I shall profit by Cambessedes' observations in all I have to say upon the order. Ternströmiaceæ may be compared, in the first place, with Guttiferæ, with which they accord more closely than with any thing else, and in the affinities of which they entirely participate. They differ thus: in Ternströmiaceæ the leaves are alternate, to which there are scarcely any exceptions; they are always opposite in Guttiferæ. In the former the normal number of the parts of the flower appears to be 5 and its multiples; in Guttiferæ it is evidently two. In the former the calyx is always perfectly distinct from the corolla; these two organs are usually confounded in the latter. Ternströmiaceæ have the petals generally united at the base, and a twisted æstivation; in Guttiferæ they are distinct, with a convolute æstivation. The seeds of the former are almost always either destitute of albumen, or furnished with a membranous wing; the latter have neither the one nor the other. The first have the radicle always near the hilum; the second have it either near the hilum or turned in an opposite direction. Finally, in Guttiferæ, the cotyledons are very thick, and firmly glued together; and this character, which is not observed in Ternströmiaceæ, is the more important, as it is not liable to any exception. Ternströmiaceæ are allied to Hypericaceæ through the medium

of Carpodontos, a genus which, with the foliage of the latter order, has the fruit of the former; and also of certain plants of Hypericaceæ, which, according to Cambessedes, have a definite number of seeds. With Marcgraaviaceæ they agree through Norantea, which has the stamens slightly adherent to the base of the petals, and fixed anthers; but that order is entirely different in habit, and is well marked by its singular cucullate bracts, its fruit, and its wingless exalbuminous seeds. Many genera of Ternströmiaceæ, such as Kielmeyera and others, have the habit of Tiliaceæ, while the fruit of Laplaceæ is strikingly like that of Luhea; but the æstivation of the calyx and many other characters distinguish them."

Geographical Distribution. The species of this order are for the most part tropical plants, some however, nearly confining themselves to the more elevated and cooler regions. The Gordonias and Cleyeras of the Peninsula and Ceylon are with one exception, so far we yet know, from the highest hills, that one is from Courtallum. The Neilgherries, the Pulney mountains, the elevated regions of Nuera Ellia in Ceylon, all produce species of one or both of these genera, while the on the lower hills I have only once seen or heard of either. Eurya and Cochlospermum on the other hand, both descend to the plains. Ternstræmia is found at Courtallum in the shady jungles covering its hills. Camellia has not yet, so far as I have heard, been found either in the Peninsula or in Ceylon.

Of the whole order 40 species are enumerated as Indian in Dr. Wallich's list of Indian plants, whether all these will stand the test of further and more miuute examination than, in the circumstances under which that list was prepared it was possible to give, appears doubtful, but whether or not, it seems certain that the amount of Indian species brought to light of late years is very considerable, since, at the date of the publication of the first volume of DeCandolle's Prodromus (1824) of sixty-two species known, for the whole world, only 19 were of Asiatic origin, nearly all the rest were from the West Indies and continent of America. Dr. Lindley states " that between 60 and 70, all beautiful trees or shrubs are found in South America, while a few only are known from the northern division of that continent."

The geographical distribution of the order in India, both generally and individually, as regards particular genera and species, has recently attracted much attention with reference to the extension of the cultivation of the tea plant, it having hitherto been supposed, that it would not thrive, at least to such a degree as to render its culture an object of commercial importance, beyond the limits of those districts in China whence the produce has been so long and so largely exported.

Properties and Uses. These are but little known, and probably with the exception of Tea, are of but secondary importance. As ornamental objects, several species are largely cultivated, but above all the Camellia japonica, the pride of gardeners. The seeds of *C. oleifera* afford an excellent table oil and I dare say a similar is extracted from the seeds of the tea plant in those districts were it abounds, as they are known to contain so much oil, that it is difficult to keep them in a state fit for vegitation for even a few weeks. I do not however find it any where mentioned that the seeds are so applied. Some species are employed in America for medicinal purposes, and in some parts of this country the gum of *Cochlospermum Gossypium* (the yellow flowered cotton tree) is used as a substitute for gum *Tragacanth*. None of the species of the order are mentioned by Ainslie, in his Materia Medica, whence it would appear, they are but little it at all known to the native practitioners of India. On the properties of tea it would be out of place to dilate, since almost every one can give some account of them from personal experience, but on the capabilities of this country for its production a few remarks might be offered as the subject is one, at the present time, engrossing much attention.

The very elaborate dissertations of Messrs. Royle, McClelland, and Griffith, have put us in possession of much, and most valuable information, bearing on nearly every branch of the inquiry. Messrs. Royle and Griffith discuss in great detail the various points relating to the vegetable statistics of the plant, more especially those appertaining to its climatic habits, and the vegitation with which it is associated in its native country, in the hope of discovering from these data whether the climate it prefers, partakes more of the tropical or temperate character; that is, whether the tea plant, indigenous as it is to the tropics and their immediate confines, yet seeks the cool climate of high hills, or is contented to submit to the

warmth of the plains: and lastly to ascertain whether, in attempting to extend its cultivation to our Indian possessions, we should locate it on a dry rather poor soil, with an open exposure on the hills, or in low, moist, shady places, on the plains.

Mr. McClelland examines with equal care and success, the peculiarities of the soil in regard to its geological relations, and chemical qualities: the character of the climate with reference to its humidity and heat: the quantity of rain that falls, the degree to which the country is overcast with clouds and mist, and the effect of these last on the distribution of the plant over the valley of Assam.

To attempt a detailed recapitulation of the facts and arguments adduced on all sides, bearing on the questions discussed in these papers, would take much more time and space than I can now devote to the subject, but as I think I have succeeded in making myself master of the leading features of the inquiry I shall endeavour to place before the reader a summary of the results.

Mr. Royle, in a very elaborate article on the subject, in his Illustrations of the Botany of the Himalayan mountains, comes to the conclusion, that, the Tea plant is virtually a native of a temperate climate, and that the slopes of these mountains afford the most proper climate and soil for the growth and culture of this plant, the former, as partaking of the character of the tropics during one half of the year, and of the temperate zone the remainder; the latter as being formed from the detritus of primitive rocks. In arriving at this conclusion, which is nearly in accordance with the opinion advanced by Dr. Abel, whom he seems to consider beyond all comparison the best authority, Mr. Royle has evidently been misled, by reposing too great confidence in his guide, since, strange to say, the inference is at variance with nearly the whole of the evidence adduced by himself in support of it. Were the case really such as he puts it, the south of Europe would afford nearly every requisite for the successful cultivation of tea, but I greatly fear. if ever put to the test of experiment, that some of the principal requisites will be found wanting. His views are however so well supported, and the contradictory evidence on which they are made to rest, so ingeniously explained away, that much difficulty must have been experienced in detecting his errors, had not actual and careful examination of the circumstances under which the plant is produced in its native country, enabled the deputation of the Tea committee who went to examine them, to point out the very erroneous nature of the opinions advocated by Dr. Abel, which Mr. Royle had adopted, and supported with such a fruitless expenditure of ingenious reasoning.

From the investigations of the deputation it appears, that so far from being a plant seeking the cool climate, clear sky, and dry soil afforded by the combined operation of elevation, free exposure to light, and the rapid drainage of alpine slopes, that the very opposite of all these, are the circumstances in which, in its native country, it seems to delight. There it was found on mounds but little elevated above inundation, but in a porous absorbent soil, under the shade of trees so dense that the rays of the sun could scarcely penetrate, and what is still more remarkable, was confined to one side of the valley of Assam, so subject to be covered with thick mists and fogs during the cool season, that it was estimated to enjoy less sunshine by 2 hours daily than the other, where the plant was never seen, though in the enjoyment of a clear sky, bright sunshine, and a temperature greatly reduced by the vicinity of snow-capped hills. The climate of Assam all accounts agree in representing as very humid with a moderate range of temperature, rainy wet weather prevailing through the greater part of the year, and often dark and foggy in the intervals. Thus Mr. Griffith observes Hort. Trans. vol. 5 page 145.

"With regard to humidity Assam may be considered as enjoying the maximum. The rains are of long continuance; they commence in March and last till about the middle of October. During May, June, July, August and September, the fall is steady but not very severe. During March and April the fall is irregular, often accompanied by violent squalls from the S. W. November and January are the only months throughout the year on which tolerable reliance can be placed for a continuance of fine weather, as rain always falls about the middle of December."

The following seem to be the points meriting most attention in respect to the peculiarities of soil, climate, and exposure favourable to the growth of the tea plant, as observed in its native jungles in Assam, and which of course ought to be, as much as possible, sought after in attempting its cultivation elsewhere. They are extracted from the reports of Messrs. Griffith and McClelland published in the 4th and 5th volumes of the transactions of the Horticultural Society of India.

Soil. The following extract from Mr. McClelland's report descriptive of the first tea colony the deputation visited near Cuju will explain both the appearance of the spot and the character of the soil. On entering the forest in which the plants were growing he observes p. 19.

"The first remarkable thing that presented itself here, was the peculiar irregularity of the surface; which in places was excavated into natural trenches, and in other situations raised into rounded accumulations at the roots, and trunks of trees, and clumps of bamboos, as in the annexed figure. The excavations seemed as if they had been formed artificially, and were from two, to three, and even four feet deep, of very irregular shapes, and seldom communicating with each other. After many conjectures, I found the size of the excavations bear exact proportion to the size and height of the nearest adjoining trees, and that they never appeared immediately under the shade of large branches. The cause then appeared to be the collection of rain on the foliage of lofty trees; from which the water so collected is precipitated in heavy volumes on the loose and light soil, excavating it in the manner described.

The trenches are from one yard to ten in length, and generally a yard, or two yards wide; and their general figures correspond to the form of the interstices between the branches above. The tea plants are most numerous along the margins of these natural excavations, as well on the accumulations of dry soil raised around the roots of bamboos. The soil is perfectly loose, and sinks under the feet with a certain degree of elasticity, derived from dense meshes of succulent fibres, prolonged in every direction from various roots. Its colour is light grey, perfectly dry and dusty, although the surrounding country was still wet, from the effects of rain that had fallen for several days immediately prior to our visit.

Even the trenches were dry, and from their not communicating with each other, it seemed quite evident, that the soil and substratum must be highly porous, and different in this respect from the structure of the surrounding surface of the country.

Extending examinations farther, I found the peculiar character of the soil in regard to colour, consistency, and inequality of surface disappear, with the tea plant itself, beyond the extent of a circular space of about 300 yards in diameter."

Again he says (p. 22.) of another colony at Nigroo, "surrounded by tea plants we ascended the mound, the soil of which is light, fine, and of a yellow colour, having no sandy character" "We then traced the plants along the summit of the mound for about 50 yards when they disappeared where the soil became dark. Now descending to the foot of the mound I found the tea plant disappear where the soil instead of being sandy or clayey became rich, and stiff." Again (p. 23.) at Noadwar. "Having entered the skirts of a forest which though not under water, was wet and slippery, and in some cases deeply covered with mud; we suddenly ascended from the dry bed of an occasional water course, and at first sight discovered a total change of soil and vegetation. From floundering in mud we now stood on a light, red, dry, and dusty soil, notwithstanding the rain to which it was exposed in common with every part of the country at the time." Still speaking of the soil at Noadwar, he continues "the colour of the surface is dark yellowish brown, but on being opened it appears much brighter, and on sinking to the depth of three feet, it changes progressively to a deep, pure, orange coloured sand, quite distinct from any of the other soils, or subsoils in this part of the district; and in this remarkable situation the tea plants are so numerous that they constitute a third part, probably, of the entire vegetation of the spot. The red soil disappears gradually within the limit occupied by the tea plants. I observed the level of the waters in the wells in this neighbourhood, to be about ten feet below the surface of the ground.

From these examples it will be observed that a light, porous, yellow or redish soil, is the kind which this plant naturally prefers, but situated in the midst of water and inundation on slightly elevated mounds, supposed by Mr. McClelland to be themselves sometimes inundated. It will further be observed that the sites, always of small extent, occupied by the tea plant were invariably in forests under the shade of trees, both of which circumstances ought to be well attended to in any attempts made to extend its cultivation.

Climate and Exposure. Under this head I find it most difficult to elicit precise information from the authorities before me, owing to the contradictory nature of the details, originating, not in the want of care on the part of the writers for they have examined the subject with much attention, but owing to the vast extent of surface over which the tea plant is produced, and the remote situations of the countries in which

it is cultivated. It is now grown with success in Java under the equator, and is said to be cultivated as far north as the 40° of northern latitude, it is also cultivated on the banks of the Rio Janeiro in 22½ S. latitude. In Siam and Cochin-China between the 10th and 16th parallels of N. latitude, it is produced in considerable quantity; while in China, judging from the enormous quantities exported, and the still greater consumed among themselves, it is clear it must occupy very extensive tracts of country, and be subject to very great varieties of climate, both as relates to temperature and humidity, and in my opinion, goes far to prove that it may be cultivated with success in almost any tropical climate, combining humidity with a moderate range of temperature. It is true we are told that unless the climate partakes more of the temperate than tropical character, that the tea produced will be deficient in some of its most esteemed qualities, the fine Aroma &c., but these I suspect it owes more to soil and skilful preparation of the leaves when gathered, than to the character of the climate under which they have been produced. Peculiarities of soil, on which plants are grown, exert much influence on the qualities of the products of vegetation, some plants growing in a very humid or marshy soil, are intensely acrid, the common garden celery for example, but which when raised on a rich dry soil become mild and esculent. Other plants present the opposite phenomenon, that of losing their acrid or aromatic properties, when removed from a dry to a wet soil. To quote examples of the effect of soil in modifying the qualities of vegetable products would be to waste time, as every one's experience and reading must have furnished him cases in point, and that too, under circumstances in all other respects the same. In like manner there is every reason to believe that, the different qualities of tea are owing, not so much to differences of climate, as of soil, the sickly or vigorous condition of the plant when gathered, and the more or less perfect course of preparation to which it has been subjected.

In throwing out these remarks I do not mean to infer that the plant might, under proper cultivation, be made to produce tea of good quality under any climate in which it can be made to grow, but with the view of encouraging trials in such climates as the Indian Peninsula supplies, and discouraging the idea that, because we have not a climate within these limits, with a range of temperature extending from 30° to 80° of Fahrenheit's scale, that therefore it would be in vain to attempt its culture. This I do, because the regulation of the climate not being within our power, to suppose it opposed to our efforts, is at once to declare all attempts at introduction futile, but the selection and modification, by artificial means, of the qualities of the soil, being an every day occurrence in agriculture, holds out good reason to hope for success if opposed by that only.

To show however that in so far as temperature is concerned, we are not unprovided with localities enjoying a climate if not the best, yet far from unsuitable for the culture of this shrub, I extract from Mr. Griffiths' report some tables showing the mean temperature of Canton and Sadiya, from which it will be perceived that both Malabar and Mysore are not very different, while the former, as well as the south-west coast of Ceylon, enjoys a climate but little, if at all less humid, than is experienced in the vicinity of Canton.

" I extract from Mr. Royle's work the following table of the means of the several Month's at Canton, which was furnished by Mr. Reeves to Dr. Lindley.

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
Maxima.	74	78	82	86	88	90	94	90	88	85	80	70
Minima.	29	38	44	55	64	74	79	75	70	57	40	45
Means.....	51-5	58	63	70-5	76	82	86-5	82-5	79	71	60	57·5

Mean annual temperature 69—7.

And as a companion to this, I extract from Mr. Davis's work on the Chinese corresponding portions of a table, the " Result of Observations made at Canton, during a series of years."*

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
Mean. Maxima.	57	58	71	76	78	84	88	86	84	76	68	63
Mean. Minima.	45	45	60	69	73	79	84	83	79	70	61	52
Means.	51	51-5	65-5	72-5	75-5	81-5	86	84 5	81-5	73	64 5	57-5

Mean annual temperature 70—4.

* Davis vol. ii. p. 381.

TABLE FOR SADIYA.

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
Mean. Maxima	60-5	61	69	73-5	78-5	83-5	83-5	84	85	80	77	0
Mean. Minima.	47-5	52-5	56	66-5	70	76-5	76	77	76	69-5	64-5	0
Means.	54	56-7	62-5	70	74-2	80	79-7	80-5	80-5	74-7	70-7	

Mean annual temperature 67—2.

Taking the means of the tables of Mr. Reeves and of Mr. Davis, the mean annual temperature of Canton will be very nearly 70: the mean of the four hottest months in the year 82-2, and of the four coldest months 54.

The mean annual heat of Sadiya, in upper Assam, will be 67-2.

The mean temperature of the four hottest months will be 80, and of the four coldest months 57-8.

	Canton.	*Sadiya.*
Mean annual temperature,	70	67-2
Mean temperature of 4 hottest months,	82-2	80
———————— coldest months,	54	57-8

The greatest degree of cold which, so far as I know, has occurred at Sadiya, was in January, 1837, when Major White observed it on one occasion at 6 A. M. to be so low as 32_0. On another occasion it fell to 37; 42° is not uncommon. The highest range during the hot months was in 1836, 92°. It is singular that Captain Jenkins had never observed it so high as this at Gowahatti, (90 being its highest range at that place) although considering its latitude and situation, the contrary would be supposed to take place. In upper Assam, January is the coldest month of the year; August and September the hottest and most oppressive."

Were we to assume the climate of Assam as the most suitable for rearing this shrub, we might find it difficult indeed to find a parallel one in southern India, but this cannot be necessary as it is next to impossible that similar climates can be common to the various and widely separated countries where it is cultivated to so vast an extent.

Mr. CcClelland describes Assam as an extensive deluvial valley surrounded on all sides by vast mountains; those on the north extending backwards to the Himalayas which in this portion of the range are covered with almost perpetual snow; and travesed its whole length by a vast river, fed by 5 or 6 others, the least of which nearly equals the largest river in England. A valley so situated has its climate modified in a very remarkable degree by local causes—Thus owing to the proximity of the snowy mountains a cool current of air blows from the north-east at all seasons. That meeting the south-west winds from the plains of Bengal in the months of March, April and May, is productive of frequent showers bywhich the air is kept cool and moist during the season of heat and draught, again

" Throughout the cold season, dense vapours arise from the Bramaputra about day-light, and continue to increase until 8 A. M. when they begin slowly to ascend. They are then drifted before the N. E. wind, which from the diminished heat of the valley now amounts only to a gentle movement, the direction of which is modified by the action of the sun's rays on the upper stratum of mist, causing a more or less powerful dissipation, and exciting a movement in the general mass towards the side on which this action is taking place. The whole of the vapours are thus attracted towards the south, where unless entirely dispersed by noon, their broken masses linger on the northern face of the Naga mountains, receiving daily fresh accumulations, until they are precipitated in heavy rain, seldom however before they have served as an impenetrable canopy to this side of the valley for several weeks.

This tendency of the mists to occupy the south side of the valley, is an interesting point if considered with reference to what I have already stated regarding the absence of the tea plant on the northern side."

These mists are attributed to the inequality of temperature existing between the river and surrounding air; that of the former amounting to about 15° higher than the latter, hence the vapour rising from it, becomes partially condensed and has the effect of raising and equalizing

the temperature, while it preserves a constantly moist atmosphere. The striking effect of these causes on vegetation is proved, by the fact, of the tea plant being confined to the south side of the valley, or that protected by the mists from the cold wind blowing from the snowy mountains.

The fact here stated is strongly corroborative of the view above taken, that this is truly a tropical plant, delighting in a mild humid climate with a moderate range of temperature, and not one suited for bearing exposure to frost and snow during one part of the year, and a high tropical heat at another, and in so far, that the elevated ot slopes the Himalayas, recommended on that very account by Mr. Royle as a suitable locality for its cultivation, are in truth most unsuitable. The deep and sheltered valleys however of these mountains may, and probably will be found, to present a combination of circumstances most suitable for its introduction.

The only parts of the Indian Peninsula, so far as I am aware, which seem in any degree fitted for the profitable culture of this shrub are some portions of Mysore and Malabar, especially the mountain valleys of the latter, which partake of the proverbial humidity of its climate, combined with such an abundance of forests, as would at once suffice by their density to afford shade against too much light, shelter against cold blighting winds, and finally preserve an equal and humid atmosphere over the plants at all seasons of the year. Whether such a union of favourable circumstances can be found in combination with the peculiar light porous soil which this shrub affects in its native country, is not easy to say, but in a country enjoying a range of temperature rarely, if ever exceeding 85° or falling below 60°, with extreme humidity,* and abundance

* After this page was in type I was kindly favored by Mr. Caldecott, Astronomer to his Highness the Rajah of Travancore, with the following Meteorological Tables, extracted from the Records of the Trivandrum Observatory, affording for the time they occupy, the most complete series of observations that has perhaps ever been made in India or elsewhere. It is however to be observed, that, as the registers are for Trivandrum in the extreme South, they require to be slightly modified for more northern stations, especially as regards the fall of rain, which in that part of the coast between Cochin and Tellicherry exceeds that for Trivandrum by from 20 to 30 inches annually. A humid climate has been spoken of as the one best suited for the culture of the Tea plant, that, a comparisou of the register of the Wet and dry Bulb, Thermometer, will show, to exist in Malabar where, so loaded with moisture is the air, even at Trivandrum, the driest station on that coast, that at almost every season of the year, the depression of a few degrees of temperature produces a deposition of dew, and the mean Minimum heat for any month never exceeds that of the dew point by above 4 degrees, and the Minimum temperature of each month falls below that of the dew point. The elevation of temperature certainly exceeds what I have stated as the extreme, but that varies with local circumstances, and the situation of the Trivandrum Observatory is of a very different character from those I suggested as the most suitable for the culture of this shrub.

Register of the Thermometer as observed at Trivandrum.

	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	April	May
The Max. Temp. of each Month	86. 5	89. 3	89. 8	88. 3	90. 3	85 5	87. 8	87. 8	92. 0	91. 4	93. 0	93. 3
Minimum Temperature do.	70. 8	70. 3	70. 2	70. 8	71. 1	68. 8	65. 5	66. 0	67. 5	68. 8	73. 8	72. 3
Extreme range of each do.	15. 7	19. 0	19. 6	17. 5	19. 2	16. 7	22. 3	21. 8	24. 5	22. 6	19. 2	21. 0
Mean Maximum of do.	83.16	83.64	83.73	85.07	84.09	82.92	84.94	85.88	87.59	89.10	90.20	89.87
Mean Minimum of do.	73.37	73.18	73.21	73 36	73.96	72.57	71.52	69.72	71.02	73 73	75.97	76.94
Mean range of do.	9 79	10.46	10.52	11.71	10.13	10.35	13.42	16.16	16.57	15.37	14.23	12.93
Mean hour of Max. Temp. of each Month	1h.	2	1	Noon	1	1	1	2	1	1	1	1
Mean hour of Minimum	5	5	h. m. 5 30	6	5	6	6	6	6	6	6	6

The Maximum Temperature occurred on May 13th (1838) and was 93°.3
The Minimum do. do. Dec. 31st 7. A M. (1837) 65°.5

HOURLY REGISTER—WET BULB THERMOMETER—1837-8.

Table 1. *Containing the Daily and Monthly Dew Points (calculated from the depression of the Wet Bulb Thermometer) from June* 1837 *to May* 1838.

	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May
Mean ...	72.57	72.71	72.63	72.78	73.35	72.52	70.34	67.08	68.73	70.96	73.37	74.32

HOURLY REGISTER—WET BULB THERMOMETER—1837-8.

Table 2. *Shewing the Mean Dew Point of each hour for each Month, from June* 1837 *to May* 1838, *and for the whole* 12 *Months.*

	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May	Mean
Mean ...	72.56	72.71	72.64	72.77	73.34	72.53	70.34	67.08	68.72	70.94	73.39	74.33	71.78

MEMORANDUM.

Of the Quantity of Rain which fell at Trivandrum for each Month, from 3d June 1837 *until end of July* 1838.

	1837								1838							
	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total	Jan.	Feb.	March	April	May	Jun	July	Total
Inches	8.0105	10.0427	3,9344	4.7330	20.9731	19.2508	3.2163	70.1608*	,2652	.1136	.7772	2.6667	1.9012	14.7879	4.1559	24.6677

* The quantity which fell in April and May 1837 was not registered, but it must have been full 20 inches.

of forest to supply shade from the sun and shelter from the winds, there seems so many chances of success, that I would strongly urge the propriety of having the attempt made. Mr. Huxham, a not less active and enterprising than skilful planter on that coast, would, I think I may safely add though I have had no communication with him on the subject, gladly undertake the conducting of such an experiment if supplied with plants. If my conjectures as to his willingness to undertake the culture prove correct, I should recommend his being supplied with plants for that purpose, and if procurable, would advise them to be brought from China, which, from having already been long subjected to artificial culture. are likely, more readily to accommodate themselves to new circumstances than those derived from the wild stock. Once acclimated on the coast, which seems the most suitable locality for commencing the experiment, it will probably prove an easy matter to extend the culture to Mysore. On the east coast, success can scarcely be expected on account of the extreme heat and dryness of the climate.

Remarks on the Genera and Species. On this division of the subject I must of necessity be brief from want of materials to enter fully into its consideration. Mr. Griffith in his report enumerates 9 genera natives of India, after reducing one by uniting *Camellia* and *Thea*. Of these 9, the Peninsula presents species of 5, namely, *Cochlospermum*, *Ternstrœmia ?*, *Cleyera*, *Eurya*, and *Gordonia*, of the remaining four, representatives have not yet been found. To these Blume has added four from Java, one of his however, *Geeria*, is, if not wholly, certainly in part identical with the Indian Eurya.

Professor DeCandolle in his account of this order keeps it distinct from *Camelliaceæ*, and divides it into six sections or tribes. Since the publication of his Prodromus these two orders have, by the almost unanimous decision of Botanists, been united, the last being reduced to a section of the first.

Of each of these tribes or sections the Indian flora presents representatives, I shall therefore, with the view of giving a clearer idea of the whole, transcribe the characters assigned to each tribe, as given in Don's Edition of Millar's Gardener's Dictionary.

" Tribe 1st.—Ternstrœmieæ.—Calyx with 2 bracteas at the base. Petals connected together at the base, opposite the sepals. Anthers adnate. Style crowned by a simple stigma. Albumen fleshy."

Of this tribe only one genus is known, namely, *Ternstrœmia*. This is principally an American genus, but Dr. Wallich enumerates in his list of Indian plants, 7 species, though not all from the continent. Dr. Jack describes two more in the Malayan Miscellanies. Whether these are all genuine species of the genus may be doubted, with one only, *T. crenulata* Wall. I am acquainted, and with that imperfectly, as my specimens are all in fruit, but the seed departs from the character of the genus in having flattened foliaceous orbicular cotyledons, in place of linear terate ones; the radicle however points towards the hilum, and the whole embryo is inclosed in fleshy. Should a corresponding difference be found in the flower, this species will justly form the type of a distinct genus, to which several, if not all of the Indian species may perhaps be referable.

" Tribe 2d.—Euryeæ.—Calyx furnished with 2 bracteas at the base, of 5 sepals or 5 lobes. Corolla 5-parted, opposite the sepals. Anthers adnate. Style crowned by 3-5 distinct stigmas."

To this tribe three genera are referred, all of Asiatic origin, *Anneslea*, Wall. *Geeria*, Blume, and *Eurya* Thunb. Of the first, only one species is known, *A. fragrans* from Moulmain: of the second *Geeria*, Blume has defined four species, but as already remarked, part, if not the whole, are referable to the next genus. Blume himself suspects two genera may be combined under his character, though it seems more probable, they are all species of *Eurya*, as he informs us that *Geeria* only differs from *Eurya*, in having diæcious in place of polygamous flowers: surely a very inadequate generic distinction. *Eurya*, of this genus Wallich's list contains 7 species to which one has since been added from the Peninsula.

" Tribe 3d.—Freziereæ.—Calyx furnished with 2 bracteas at the base. Petals free, alternating with the sepals. Anthers adnate. Style crowned by 2-5 distinct stigmas. Seeds wingless. Albumen fleshy. Embryo rather curved."

Species of two, of the three genera referred to this section are found in India. Of *Clyera* one species is found on the Neilgherries, one in Ceylon, and three in Nepaul. One species is referred with doubt to the genus *Freziera* by Wallich, which he suspects may prove a Camellia, whether or not this conjecture is well founded, it is imposible for me to say, but as all the other members of the genus are from America, it is more than probable this is not one.

" Tribe 4th.—SAURAUJEÆ.—Calyx deeply 5-parted, furnished with 2-3 bracteas. Petals alternating with the sepals, more or less connected together at the base. Stamens numerous, adhering to the base of the corolla. Anthers incumbent, inserted by the back, not adnate. Styles 3-5, distinct from the ovary. Seeds wingless. Albumen fleshy."

Two genera are referred to this tribe *Saurauja* and *Apatelia* the former, nearly, altogether of Asiatic, the latter of American origin. Of *Saurauja* Wallich enumerates 4-continental species, and one from Penang: Blume has no fewer than 9 from Java alone. None have yet been found in the Peninsula.

" Tribe 5th.—LAPLACEÆ.—Calyx bractless of 3-5 sepals, sometimes 5-parted. Petals usually 5, distinct. Stamens numerous, free, or connected at the base. Anthers adnate or versatile. Styles equal in number to the cells of the ovary, joined in 1, crowned by many stigmas. Fruit 3-5 celled. Albumen fleshy or wanting. Seeds compressed or winged, rarely cochleate."

To this tribe, the largest of the order, only one Indian genus is referred, namely *Cochlospermum,* which was long supposed, on account of the woolly covering of its seeds to be a *Bombax,* whence, the only species found in this part of India had received the name of *B. Gossypium,* under which name, it is well described in Roxburghs Flora Indica.

" Tribe 6th.—GORDONIÆ—Sepals 5, free, or joined together at the base. Petals usually connected at the base. Stamens numerous, monadelphous at the base. Anthers ovate, oscillatory. Styles 5, distinct or connected. Carpels 5, capsular, few or many-seeded, sometimes distinct, sometimes connecte d into a single fruit, with a dissepiment in the middle. Albumen wanting. Embryo straight, with an oblong radicle, and leafy cotyledons, which are wrinkled and plaited lengthwise, with an inconspicuous plumule."

DeCandolle refers this tribute with a doubt, to the order, but Cambessedes who re-examined the whole order seems to have no doubt on the subject, as he retains in his enumeration all the genera referred here by DeCandolle. Of these *Gordonia* is the only one found in India, and of it Wallich has 9 species one only from the Peninsula. I have since found another at Courtallum, and have one from Ceylon.

" Tribe 7th.—CAMELLIA.—Sepals 5-9. Petals 5-7-9, usually cohering at the base. Stamens numerous, monadelphous, or polyadelphous at the base. Anthers versatile, 2-celled. Styles 3-5, connected at the base. Fruit 3-celled, 3 valved, few seeded; valves with a dessepiment in the middle (loculicidal dehiscence) or bent in at the margins so much as to form dessepiments (septicidal dehiscence.) Albumen wanting."

This tribe forms in DeCandolle's Prodromus, a distinct order, including two genera *Camellia* and *Thea.* These genera have hitherto been kept distinct on account of a supposed, difference in the dehiscence of their fruit: the one *Camellia* being said to have a loculicidal dehiscence, that is, the valves splitting along the back, midway between the septa or partitions which then form a projection in the middle of the valves; the other *Thea,* a septicidal dehiscence, that is, the partitions themselves splitting These septa being composed of two inflexed cohering laminæ, often separate, at the period of maturity, and form two thin marginal partitions between the cells of the capsule.

The researches of Mr. Griffith with species of both genera in all states of fructifi cation before him, have convinced him, that there is not the least foundation for the distinction which has here been attempted to be established: the dehiscence of both being valvate and the fruit a 3-celled capsule, in short that *Camellia* and *Thea* form but one genus. Cambessedes, who, recently wrote a monograph of the order, and, as above remarked, came to the conclusion that

the preceding sections of DeCandolle were untenable, not only keeps these genera distinct, but places seven genera between in his arrangement. The memoir itself I have not seen and cannot state his reasons for placing them so far apart. but it appears, from a remark of Griffith, that he was not acquainted with the fruit of *Camellia*, which may in some degree account for this unnatural separation. No species of *Camellia* has yet been found in the Peninsula of India.

After this article was written, and partly printed, I received Professor Meisner's Genera Plantarum* in which he gives in a tabular form, generic characters of all the genera of each natural order. From this work I have become acquainted with Cambessedes' characters of *Camellia* and *Thea* which, with a view to the fuller elucidation of the subject, I shall transcribe. Departing from the distribution adopted by Cambessedes he (Meisner) places them nearly side by side in the same section, under the following sectional character.

Sectional Character.—" Petals 5 more or less united at the base—Styles 3-5 cleft or parted, (that is composed of 3-5 styles united at the base or beyond the middle but not their whole length up to the stigmas.)"

Camellia.—Calyx of 5-9 sepals, often in 3 series, the interior ones larger. Petals 5-9. Styles more or less deeply 3-5 cleft. Ovary 3-5 celled. Cells 5 or many ovuled ; ovules pendulous, partitions thick, capsules woody, ovate, loculicidal, 3-4 valved.

Thea.—Calyx 5 parted, segments equal. Petals 5-9. Styles 3 cleft above the middle. Ovary 3 celled. Cells 4 ovuled, the two superior ovules erect the two inferior ones pendulous. Capsule 3 celled (often by abortion 2-1 celled) cells opening at the apex, one, rarely 2, seeded. Seeds wingless exalbuminous.

From a comparison of these characters it will be at once observed that the only point of structure not common to both is confined to the ovules, and the dehiscence of the capsules, which, in *Camellia* are said to be 5 or many and all pendulous, with loculicidal dehiscence, while in *Thea* they are described as limited to 4, namely, 2 ascending and 2 pendulous, and the cells opening at the apex. Mr. Griffith having ascertained that the dehiscence is the same in both, has removed one of the marks, and that the other can alone be admitted as a good generic distinction, I am far from thinking, though I confess, that in many instances even small genera are broken down on equally trivial grounds. But I consider the practice a bad one, and therefore fully agree with Mr. Griffith in thinking these two should be united.

EURYA.

The species of this genus are of difficult discrimination, and I begin now to doubt whether *E. Wightiana* and *E. tristyla*, are really distinct. The specimens from which the characters were taken certainly look different, but they were few in number. Considerable additions to my stock have, by supplying intermediate forms, rendered it probable that they are but varieties differing principally in luxuriance. I mention this with the view of directing attention to the subject. Assuming that they are distinct, I have now, from Ceylon, an intermediate form differing from both, in the leaves having the thick coriaceous texture of the one, and the large size of the other, while it differs from both in having hairy branches: this, on the supposition that the others are distinct, must form a species. I therefore call it

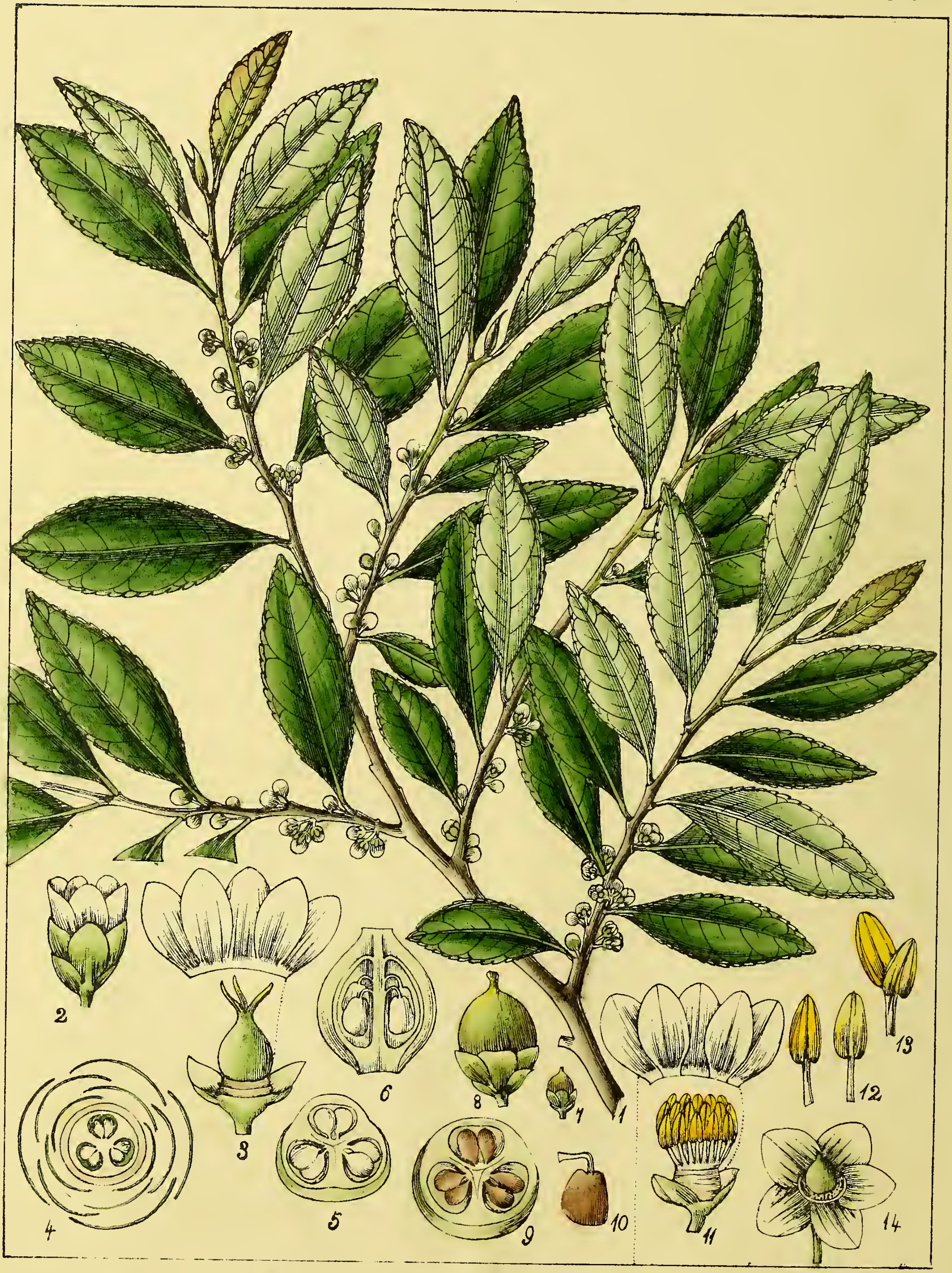
E. Ceylanica, R. W. extreme branches and costa of the leaves, hairy, leaves coriaceous, oval, acute at the base, retuse, and somewhat acuminated at the point, serrated and revolute on the margin, glabrous: flowers fasciculed, fruit small, crowned with the short persistent style and 3 stigmas.

Ceylon.—Colonel Walker.

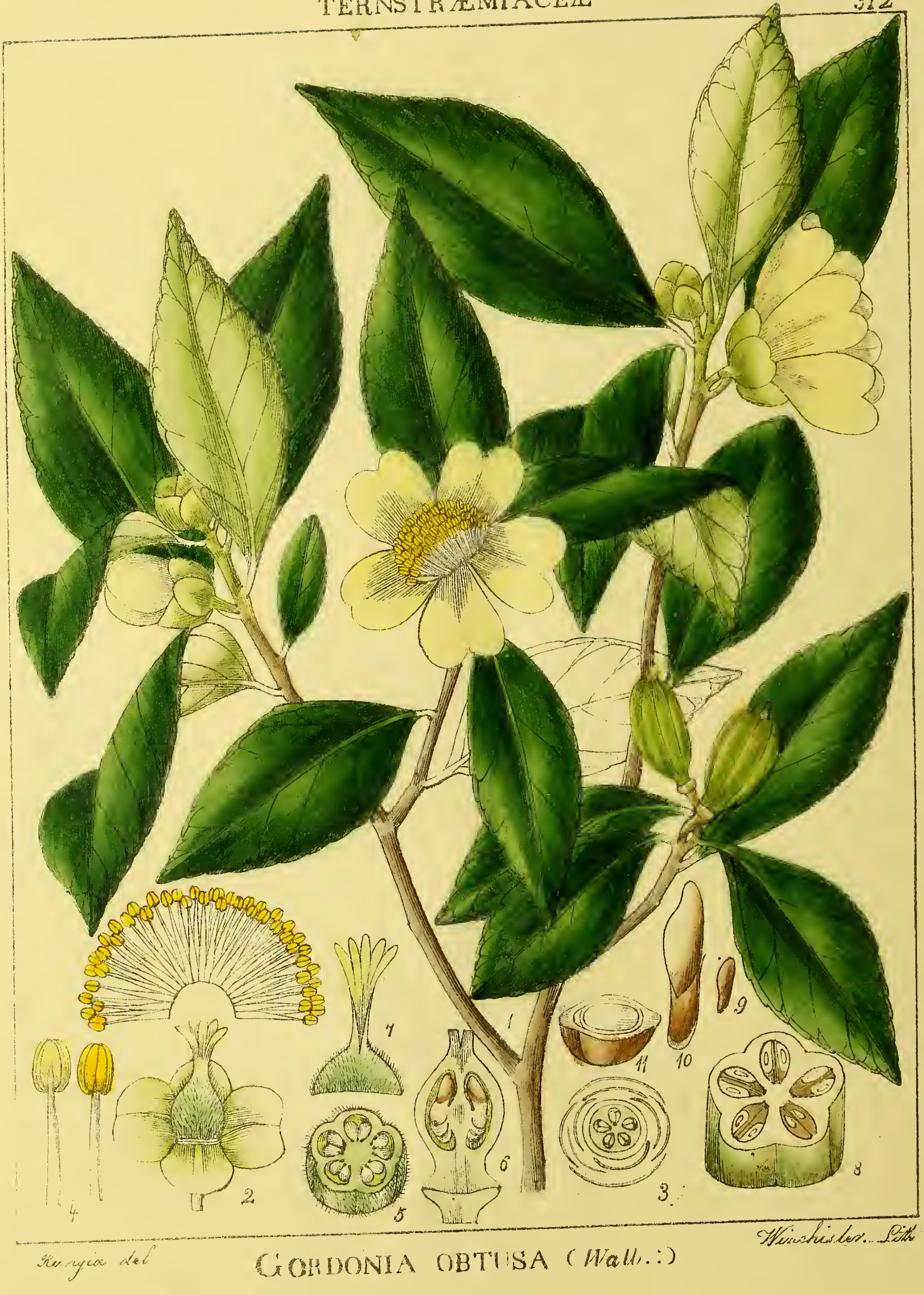
My specimens are in fruit, and I have not seen the flowers. The leaves are from 1½ to 2 inches long, and about half the breadth in the broadest part; very hard and coriaceous in their texture, glabrous on both sides, except the prominent midrib, and finely serrated on the margin. The hairy branches seem to afford the best distinctive mark.

E. angustifolia which I have not found since my return to India, but of which I have received specimens, through the kindness of Mr. Griffith, from Mergui, appears certainly distinct.

* " Plantarum Vascularium genera, corumque characters et affinitates, Tabulis Diagnosticis exposita, et secundum ordines naturales digesta." I may here observe with reference to the *Elæocarpeæ* as arranged in this most valuable work, which I shall very often have occasion to quote, that Professor Meisner reduces the order to a section of, Tiliaceæ and adopts DeCandolle's *Aceratium* and *Elæocarpus* still retaining his characters. The genus *Monocera* is also retained, with most of the species I have indicated referred to it. For the reasons already stated, I cannot agree with the able author in retaining all the three genera—*Ganitrus* is not taken up as a distinct genus in this arrangement. One error into which he has inadvertently fallen, I have met with and shall here notice. Dr. Meisner observes that we (Wight and Arnott) have in our Prodromus, referred the genus *Lophira to Dipterocarpus*. This is a mistake, originating in our having quoted Gærtner's plate, No. 188, for *Dipterocarpus* without noticing *Lophira* which is figured in the same plate, but the genus *Lophira* is not once mentioned by us, whence I infer, he had not consulted the plate when writing his commentary.



EURYA WIGHTIANA (*Wall.*)



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GORDONIA OBTUSA (Wall.:)

TERNSTRÆMIA.

Of this genus we remark in the Prodromus page 86, " Dr. Wallich (list No. 3723) enumerates *Ternstræmia crenulata* from the Madras herbarium, with which we are not acquainted."

In my herbarium there is a specimen so named, but with a doubt (?) to which the following memorandum is appended.

" *Ternstræmia?* but albumen wanting—Berry dry, 2-celled, at length, 2 valved, loculicidal, ovules 2 ? in each cell, seeds, one ripe in each cell, pendulous, wingless, plane on the inner side convex on the outer, albumen wanting, cotyledons flat, foliaceous, radicle small, straight, superior, testa of the seeds thick like parchment."

Of this plant I have since got numerous specimens, but all in fruit, so that I am still unable to give any account of the flower, but further examination with better materials has enabled me to correct an error in the above memorandum. The plant is a considerable shrub, with the leaves nearly confined to the ends of the branches, below which, on the naked portion of the branch, the berries are congested. The leaves are oval, oblong, acute at both ends, terminating in a short abrupt acumen, quite entire, somewhat coriaceous and glabrous on both sides. The berries are sessile, globose, pointed with the short persistent base of the style, glabrous, 2-celled, with a solitary pendulous seed in each, as above described, but the seed in place of having a thick testa like parchment and being exalbuminous I now find has a very thin testa, closely adherent to a copious albumen, enclosing the embryo. Hence this plant only differs from the genus, so far as we can learn from the fruit alone, in having a foliaceous not a terate curved embryo, a difference however, which may be found accompanied with othercharacters sufficient to remove it from the genus. A figure of this plant will shortly be published in the Icones.

CLEYERA.

Of this genus I have one species from Ceylon, which appears new, so far at least as can be judged from the very imperfect characters by which the species generally of this genus are distinguished. One of its most prominent features is a thick coat of hair on the back of the petals.

C. lasiopetala R. W. arboreous, leaves from oval oblong obtuse, to obovate spathulate, tapering at the base, coriaceous, entire, glabrous; flowers axillary, solitary, pendulous; sepals 5, with 2 small bracteas at the base; petals 5, very hairy on the back: anthers sprinkled with erect (not retuse) hairs: fruit globose.

Ceylon.—Colonel Walker.

The station is not mentioned but judging from the appearance of the plant, I infer it is from the more elevated regions of the country.

GORDONIA.

I found at Courtallum what appears a new Peninsular species of this genus, but which may possibly be only a small leaved variety of *G. obtusifolia*, and saw another at Nuera Ella in Ceylon, of which I had previously received specimens from Colonel Walker. They may be thus distinguished

G. parvifolia R. W. leaves from elliptic to ovate lanceolate, bluntly acuminated, retuse or emarginate, acutely, crenately serrated, glabrous; flowers axillary solitary, sessile, confined to the ends of the branches.

Courtallum in dense jungles.

This is perhaps too nearly allied to *G. obtusifolia*, but differs in the leaves of this being lanceolate, tending to ovate; in that to obovate cuneate; in this the largest do not exceed an inch or inch and half in length, and about half the breadth, while in that, they are usually twice the size: in this they are acutely crenato-serrated, in that the serratures are scarcely perceptible, both are glabrous, and in both the flowers are subsessile.

G. Ceylanica R. W. arborious, glabrous, leaves sessile, quite entire, from elliptic to oblong lanceolate, acute, tipped with a small retuse glandular point: flowers axillary on short peduncles; petals 5, obcordate: stamens very numerous, anthers oblong; ovary hairy, stigmas 5, clavate.

This species is nearly allied in some points to obtusifolia, but I believe quite distinct.

EXPLANATION OF PLATE 33.

1. Eurya Wightiana, male plant—*natural size.*—2. A female flower.—3. The same dissected, showing the ovary and styles with the corolla opened, to bring into view the union of the petals at the base.—4. A diagram, exhibiting the arrangement of the floral envelopes.—5. The ovary cut transversely, showing its 3 cells and inclosed ovules.—6. The same cut vertically, to show the superposed vertical ovules.—7. Full grown fruit—*natural size.*—8. The same *magnified.*—9. The same cut transversely.—10. A seed with its podosperm.—11. Male flower dissected.—12-13. Anthers, the latter showing an occasional union of filaments.—14. The calyx and rudimentary ovary, the petals and stamens removed to bring it into view—*all more or less magnified with the exceptions specified.*

EXPLANATION OF PLATE 39.

1. Gordonia obtusa—*natural size.*—2. A dissected flower, the petals removed, and the stamens separated to show the superior ovary and their slight union at the base—only four sepals are seen in the figure while five is the regular number, but the fifth being external usually separates with the bractioles.—3. A diagram of the parts of the flower, but imperfect with reference to the external sepal and bractioles.—4. Stamens back and front view.—5. Ovary cut transversely.—6. The same cut vertically, showing the ascending ovules.—7. The upper half of the ovary with style and stigmas.—8. A fruit cut transversely.—9. A seed—*natural size.*—10. The same magnified, showing the wing-like appendage.—11. The same cut transversely—*with the exceptions mentioned all more or less magnified.*

XXX—OLACINEÆ.

A small order, nearly confined to the tropics, consisting for the most part of shrubs or small trees, often climbing or diffuse, more rarely erect, and armed with spines. The leaves are exstipulate, alternate, simple, petioled, undivided and entire: more rarely as in *Balanites*, bifoliolate. The flowers are bisexual, or occasionally, by abortion, polygamous, or dioicous, small, axillary, racemose.

Calyx small, either entire and slightly toothed, or 5 sepaled, often, when entire, becoming enlarged with the fruit. Petals 3-5-6, either separate or adhering in pairs; æstivation valvate. Stamens 3 10, either all fertile, or with alternate sterile ones, hypogynous, often variously united with the petals, either opposite to them when the flowers are symmetrical, or wholly or partially alternate, when unsymmetrical: filaments compressed: anthers oblong, bursting longitudinally. Ovary 1-5 celled, with pendulous ovules. Fruit drupacious indehiscent, occasionally surrounded by the enlarged calyx, 1-celled, 1-seeded. Seed usually pendulous. Albumen copious, fleshy. Embryo with the radicle next the hilum.

In *Olax*, the fertile stamens alternate with the petals and unite them by pairs; in *Ximenia*, and also *Opilia*, they are opposite the petals, not the sepals in the latter, as stated, through an oversight of the authors, in the Flora *Senegambiæ*, who seem to have overlooked the minute calyx of that genus. In Gomphandra Wall. (list No. 3718) which seems nearly allied to *Stemonoous*, Blume, the stamens equal the petals, and alternate with them, while the flowers are usually unisexual by abortion.

Affinities. These are very uncertain, most authors however agree in adopting DeCandolle's arrangement, and place them near *Aurantiaceæ*, with which they unquestionably have many points of affinity. But on the other hand, the character of the seed of *Olacineæ* is so totally at variance with what we find in *Aurantiaceæ*, that it is not easy to reconcile one's self to view that as a natural arrangement, which places plants differing so widely, in so essential an organ as the seed, side by side. Mr. Brown takes a very different view of their structure. He considers them apetalous, viewing the organs called petals by other authors as sepals, and their sepals as an involucrum. According to this view of its structure, the order should occupy a place near *Santalaceæ* and *Thymaleæ*, with which it agrees in the character of its seed. In opposition to this view, it may be stated on the one side, that *Balanites* which is now referred to this order has distinct sepals and petals, and on the other, that *Ternstraemiaceae*, and especially the genus *Ternstrœmia* has the embryo in the midst of a copious albumen somewhat similar to what we find in *Opilia*, and *Balanites*. For these reasons, added to the similarity in various points between the flowers of *Ximenia* and *Balanites*, to those of the *Aurantiaceæ*, I do not see that, in the present state of our knowledge of the order, we can assign it a more suitable place than that which it now occupies, between these two orders, the relationship of which seems generally admitted.

Geographical Distribution. As already remarked, the order consists almost entirely of tropical shrubs or small trees. Though few in number they have a wide range, being met with with in, or on the confines of the tropics in Asia, Africa, America, and Australia.

In continental India 5 genera are found, and one more from Java, altogether 6 of the 12 genera referred to the order. The continental ones are *Olax*, *Gompandra*, *Opilia*, *Ximenia*, and *Balanites*. *Olax* is also found on the banks of the Congo, while the three last are found in Senegal, and apparently the same species. *Ximenia Americana* is common to three quarters of the globe. *Balanites* is equally a native of India and of Africa, and has been well described by Roxburgh under the name of *Ximenia Ægyptiaca*. Of this genus I possess specimens and drawings, the latter of which will shortly be published in my Icones. The genus *Olax* extends from Ceylon northwards to the Himalayas, and from Malabar eastwards to Java, while *Spermaxyrum*, a genus scarcely distinct, represents it in New Holland. With this almost unlimited range, in respect to longitude in its distribution over the torrid zone, this order can scarcely boast of more than 30 known species, about 20 of which are natives of India and

her islands, but this list I feel assured will soon be extended, now that the characters of the order are becoming better known.

PROPERTIES AND USES. Little is yet known of these. In Ceylon, it is said the leaves of *Olax Zeylanica* are used as pot-herbs, and as salads, whence they have received a native name synonymous, with " tree salads," a designation which does not seem limited to one plant, since I have met with a very different one in gardens about Madras, under the name of " Tree Lettuce" referable to the order *Nyctagineæ*, apparently a species of *Pisonia*. The rind of the fruit of *Ximenia Americana* is described as bitter and astringent, the flesh as purgative, and the kernel sweet and pleasant tasted. Roxburgh in his Flora Indica 2 fig. 253, remarks of this shrub. " The ripe fruits are eaten raw by the natives : their taste is a compound of sour and bitter, the kernels are also eaten, and taste much like fresh filberts. The wood is yellow, like sandal, and its powder is often substituted for that of sandal by the Brahmins in this part of the coast in their religious ceremonies." The nut of *Balanites Ægyptiaca* is covered by a quantity of soft pulp, not inaptly compared by Roxburgh to soft soap " intensely bitter, and having an offensive greasy smell." The nut itself, is exceedingly hard, and is employed in fireworks. For this purpose a small hole is drilled in it, the kernel extracted, and the shell filled with powder, when fired it bursts with a loud report. Such is the only use to which it seems to be applied in India. The authors of the Flora Senegambiæ inform us that the flowers are very fragrant, that the pulp previous to maturity is a strong purgative, having an acrid bitter taste, exciting for a long time a burning pain in the throat, but that, when perfectly ripe, it has an agreeable taste and is eat with pleasure by the Negroes. The wood which is of a yellow colour is very hard, and in Africa esteemed excellent for making furniture.

REMARKS ON GENERA AND SPECIES. As above remarked 5 genera of this order are now known to exist in India, these are *Opilia*, *Olax*, *Ximenia*, *Gomphandra*, and *Balanites*. The first of these, the true place of which in the natural system was long unknown, was satisfactorily determined about the same time by Messrs. Guillemin and Perrottet, and by Mr. Arnott and myself, though we were not aware at the time that ours was that plant. Of this genus only one species has yet been found in India, *Opilia amentacea* Roxburgh, to which our *Ximenia olacioides* must be referred, as being founded on a specimen of that plant in fruit, which at the time we wrote was unknown to us, but which I have at length succeeded in determining by comparison with specimens in fruit, taken from plants still in flower. Whether the Senegambian species (*Groutea celtidifolia* of the authers of that flora), be the same, I am not quite certain, but think it is distinct. Of the genus *Olax*, several species are found, both in India and Ceylon, Wallich in his list enumerates 10 species, but perhaps not all genuine. *Ximenia Americana* is common to America, the west coast of Africa, and India ; and is remarkable for having its stamens opposed by pairs to the petals and not alternately opposite, which is the more usual structure. *Stemonurus* referred here by Dr. Meisner, was established by Blume, in his Javanese Flora, and referred by him to Santalaceæ, with which it certainly does not associate so well. This genus as above remarked seems very nearly allied to, if not identical with Wallich's *Gomphandra* as defined by Lindley in his natural system of Botany, page 439, with this difference, that Wallich's plant has 4 in place of 5 or 6 sepals, petals, and stamens, and unisexual in place of usually bisexual flowers. Of both these genera I now possess specimens, the former from Maulmain, and the latter from Ceylon, Courtallum, the Pulneys and elsewhere. In *Gomphandra*, the flowers are 4 or 5 petaled, unisexual by abortion, the male ones having rudimentary ovaries, the female ones sterile stamens. The ovaries are 1-celled, with 2 long pendulous ovules, surmounted by a very large sessile stigma.

Professor Meisner in his tables distributes the genera under two principal sections, those with simple, and those with bifoliolate leaves. The first division is further divided into two sub-sections, those with fleshy indehiscent fruit, and those having a capsule dehising at the apex. The last sub-section has only one genus, and that referred here with a doubt. The remaining genera are then thus disposed—" Antheriferous stamens fewer than the petals—*Olax*, *Spermaxyrum*, and *Fissilia*. The two last are probably not distinct from the first.—Stamens more numerous than the petals without sterile ones, calyx minute, *Ximenia*, &c.—Stamens equalling the number of petals and hypogynous, flowers often unisexual. *Stemonurus*, *Gomphandra*, and *Opilia*, belong to this section, but are not placed here by Meisner,

the first from his not knowing any thing of the genus, the last owing to his supposing the flowers apetalous, which is not the case, *Gomphandra* is not in his list. I subjoin generic characters of *Opilia*, *Stemonurus*, *Gomphandra*, and *Balanites*, which have not yet been introduced into our Prodromus, though I now possess peninsular specimens of all except *Stemonurus*, and of that I think I have Peninsular specimens, but do not feel quite certain.

Opilia.—Roxburgh,—(*Grontea* Flor. Senegam.) Calyx very short, truncated, concreted with the torus, and not afterwards enlarging. Petals 5 inserted into the margin of the calyx, oblong, linear, at first slightly cohering at the base by their margins, afterwards distinct and revolute. Stamens 5, opposite the petals, inserted with, but distinct from them. Glands 5, alternate with the stamens thick and fleshy, truncated, about as long as the ovary. Ovary oblong, solid below, 1-celled in its upper part. Ovule solitary, pendulous from the apex of a central placenta that rises from the bottom of the cell. Style none, stigma of 3 blunt points, fruit drupacious (at first fleshy afterwards coriaceous, becoming when dry crustacious) one seeded. Albumen amigdaloidal. Embryo cylindrical, slender in the axis of the albumen, and nearly of the same length. Cotyledons semi-terate long conferruminate; radicle short, obtuse, superior.—Small trees, with slender branches, alternate short petioled, quite entire, or slightly serrated, glabrous, shining, leaves, the petiols jointed at the base. Racemes axillary, at first closely imbricated with small peltate roundish 2-4 flowered caducous scales. Flowers small, greenish yellow.

O. Amentacea Roxb. Cor. Plants and Flora Indica.

Ximenia Olacioides, W. and A. Prod. page 89. Found in hilly tracts of country. Roxburgh found it in the Circars, and I have recently received profusion of specimens from the hills in the neighbourhood of Madras. I also have it from the Pulneys, but how much further south it extends I am unable to say. With the aid of these recent acquisitions which are both in flower and fruit I have ascertained that our *Ximenia olacioides* is this plant, on which account I have extracted from that work the character of the fruit, to complete the generic character. It seems probable, judging from Roxburgh's figure of the fruit; that there are 2 species, but I refrain from characterizing them until I have seen specimens from the Circars.

Stemonurus.—Blume—Flowers bisexual or occasionally by abortion unisexual. Calyx short, entire, or obsoletely toothed. Petals 4-5 or rarely 6, cohering below. Stamens hypogynous, equalling the nnmber of petals and alternate with them; filaments compressed, the apex and back of the anthers furnished with tufts of matted hairs. Anthers 2-celled introrse. Ovary, oblong, 1-celled, with 2 pendulous ovules. Stigma sessile, obtuse. Fruit a baccate drupe, umbilicate. Nut one seeded. Embryo small, inverse, immersed in the apex of the albumen. Trees or shrubs with alternate entire leaves, and small flowers in axillary spikes or cymes.

This character which is copied from Blume's Flora of Java, I have been induced to introduce, under the conviction that species of the genus exist in the Peninsula, and that I actually possess specimens, though I am for the present enable to find them. The genus appears very nearly allied to Gomphandra, perhaps too much so, but still they are so far distinct, that I do not, in the present state of my information feel myself justified in uniting them. The following character of *Gomphandra* is taken partly from the imperfect one given by Dr. Lindley in his Natural System of Botany, page 439, but mainly from the examination of my own specimens.

Gomphandra.—Wall.—Flowers by abortion unisexual. Calyx 4-5 toothed. Corolla 4-5 petaled, inappendiculate, inflexed at the apex, glabrous, or clothed with clavate hairs. Stamens 4-5 somewhat clavate; filaments compressed free, or slightly united, forming a tube round the ovary. *Male* flowers, anthers 2-celled, cells contiguous parallel, partly immersed in the apex, of the filament, the back, and under the cells crested with matted or clavate hairs, ovary rudimentary. *Female* flowers, calyx corolla, and filaments as in the male, anthers empty of pollen. Ovary large, (equalling the petals) 1-celled, with 2 oblong pendulous clavate ovules suspended from the apex. Stigma sessile, large, covering the whole apex of the ovary. Fruit, a dry coriaceous drupe, 1-2 seeded. Shrubs or small trees, with simple, alternate leaves, axillary,

Rungiah del. Winchester. Lith

OPILIA AMENTACEA (Roxb.)

many flowered, dichotomous cymes, and small greenish yellow flowers, numerous on the male, few on the female plant.

The peninsular species so far as I have yet seen, have glabrous flowers, the Silhet one, from which Lindley's character is taken, has hairy petals: in mine, as in his, each petal is terminated by an inflexed bristle-like point, which during æstivation hooks in between the anthers. My specimens are derived from the alpine jungles of the southern provinces, and from Ceylon. Dr. Wallich in his list names two species, and refers to others as probably included among his species of *Olax*. To these last it seems probable some of mine are referable. Respecting the two named *G. axillaris* and *G. penangiana*, Dr. Arnott observes, in an article in the *Annales des Sciences Naturelle*, that they are not truly congeners. The grounds on which this opinion is formed are not stated, but I presume he must have seen both plants before he hazarded such a statement.

Balanites.—Delile—Calyx of 5 sepals, villous, caducous. Corolla 5 petals, a little longer than the calyx; petals lanceolate, attenuated at the base. Stamens 10, filaments subulate. Anthers 2-celled, attached by the back. Ovary, surrounded by a plaited glandular disk, oblong, very villous, 5-celled, 5-ovuled. Style erect, filiform; stigma capitate. Drupe ovoid, acute, by abortion, 1-celled, 1-seeded, with a woody 5-angled nut. Seed pendulous; testa fibrous, the endoplura thickened round the radicle. Embryo straight; radicle superior; cotyledons semi-ovate, plumula diphyllous.

A tree 20-30 feet high, leaves alternate, bifoliolate, spines axillary, pedicels 1-flowered, aggregated flowers, small, whitish.

The Indian plant differs from the African, in having nearly globose, very obtuse fruit, in place of ovoid and acute as described above, whence it may perhaps prove a distinct species.

GOMPHANDRA.

The determination of the species of this genus appears most difficult, one not knowing whether to consider the very various and well marked forms, species or varieties. Among my specimens there are no fewer than five very distinct forms, which would, I have no doubt, and perhaps justly, be considered by many Botanists so many distinct species. For myself, having an objection to the multiplication of species unless on very good grounds, I prefer the inflorescence being the same and the fruit unknown in all, viewing them as varieties of one, but will indicate each form, by a distinct name and character, expressive of the form of its foliage; leaving to others to determine whether they are species or varieties

G. polymorpha R. W. dioicous, glabrous, leaves short petioled, acuminated, membranacious: cymes axillary, solitary or in pairs, about the length of the petiol, male many, female few (2-5) flowered: calyx entire, minutely 4-5 toothed: Petals 4-5, united below into a tubular corolla, glabrous: stamens projecting; anthers crested with a minute tuft of hair: fruit ovoid.

Courtallum and Ceylon in thick jungles.

α. *acuminata*, leaves oval, very broad in the middle, attenuated at both ends, and terminating in a longish linear acumen.

β. *oblongifolia*, leaves linear oblong, obtuse at both ends, ending in a short abrupt, usually blunt, acumen, (4-5 inches long and about 2 broad).

γ. *angustifolia*, leaves narrow, linear, lanceolate, acute at the base, acuminated above, (3-4 inches long, scarcely 1 broad, flowers often pentandrous).

δ. *longifolia*, leaves linear, rounded at the base, acuminated at the apex, about 3 times as long as broad, (5-7 inches long 1½-2 broad).

ε. *ovalifolia*, leaves oval, obtuse at both ends, or shortly and obtusely acuminated at the point, (2½-3 inches long by 1½ broad).

G. coriacea, dioicous, male cymes axillary, few flowered; female flowers, solitary, or 2 or 3 racemose: fruit oblong, cylindrical, leaves coriaceous from oval, attenuated at both ends, to obovate cuneate; flowers tetrandrous.

Pulneys—a very distinct species, but the written characters, do not so clearly indicate the differences between this and the preceding, as the eye.

EXPLANATION OF PLATE 40.

1. Opilia amentacea—*natural size.*
2. A scale of the amentum with its enclosed flower-buds.
3. The same outside view.
4. A flower showing the petals, stamens, glands and ovary.—5. Detached stamens.
6. The ovary cut vertically, showing the solitary pendulous ovule.
7. A full grown fruit.
8. The same cut transversely, showing the central cylindrical embryo.
9. The same cut lengthwise to shew the whole length of the embryo. This last figure through injudicious shading does not give a correct idea of the object represented.

XXXI.—AURANTIACEÆ.

This very beautiful, and on account of its fragrant flowers and delicious fruit, much admired order, of which the orange with its numerous varieties of lemons, limes, citrons, pumplemoses, &c. form the type, is generally well known in India (to which country indeed it almost exclusively belongs) even to the most casual observers of plants. But though so generally known in its more perfect forms, it is not always easy to recognize those more remote from the type of the family.

The order generally is composed of handsome flowering ever-green trees and shrubs, occasionally armed with strong spines, abounding in glands filled with volatile oil, usually very conspicuous in the leaves when held between the eye and the light, and exhaling a fragrant odour. Their leaves are alternate, simple, or compound. In the former as in the latter instance the petiols are jointed, indicating a tendency to become compound. So constantly is this the case, that simple leaves with such petiols are sometimes described as " pinnate reduced to the terminal leaflet." The petiols are often dilated or winged. The flowers are bisexual, for the most part white, variously arranged in solitary and axillary flowers, or in racemes, panicles, corymbs, &c.

The calyx is short, more or less urceolate, or campanulate at the base, 3-5 lobed, withering. Petals equalling the number of the lobes of the calyx and alternate with them, inserted outside of the torus, broad at the base, distinct, or sometimes cohering, deciduous, imbricated in æstivation. Stamens equal or double the number of the petals, or more rarely, are very numerous and indefinite, inserted in a single series into the torus: filaments compressed, either altogether free or united into a tube, or variously polyadelphous, subulate, and free at the point. Anthers 2-celled, attached by the base, or the middle of the back, dehising longitudinally, introrse. Ovary free, 2-3-5 or many celled, with one or several ovules in each. Style cylindrical, or rarely wanting. Stigma large, somewhat lobed, or flat and spread over the apex of the ovary. " Fruit (an orange) consisting of several (or 1 by abortion) membranacious carpels, with or without an internal pulp, and surrounded by a thickish indehiscent rind, abounding in vesicles full of volatile oil. Seeds attached to the inner angle of the carpels, solitary, or numerous, usually pendulous: raphe and chalaza usually very conspicuous: Albumen none. Embryo straight, radicle next the hilum, partly concealed within the cotyledons. Cotyledons large, thick and amygdaline."

Affinities. The plants of this order are most readily known by the number of oily receptacles, which are dispersed all over them; the leaves, sepals, petals, and fruit equally partaking of them; by their deciduous petals, and compound leaves, and frequently winged petiols. By these peculiarities they are nearly related to *Amyrideæ* and *Zanthoxylaceæ*, from neither of which is it always easy to distinguish them, except by the fruit. Several species referred by Roxburgh to his genus *Amyris*, actually belong to this order. From the former they are distinguished by the numerous, not solitary, cells of the ovary, and by their baccate, not drupacious, or samaroid, or legume-like fruit: from the latter their bi, not usually unisexual flowers, and their indehiscent pulpy fruit, not 2-valved dehiscent capsules seated on a gynophore, with a solitary shining black seed.

Geographical Distribution. Tropical Asia and her islands seem to be the native country of the order, a few only having been found indigenous elsewhere, of these two or three are from Madagascar, an island in which many other associates of the Indian Flora are found. DeCandolle in his Prodromus, excluding *Aglaea*, enumerates 43 species for the whole order: G. Don, who published some years later, raises the number to 60, but many of these doubtful: Blume found 21 in Java: Wallich's list has 37: and 24 are described in our Prodromus as natives of the Indian Peninsula: one or two have been since added to the Peninsular list and I have several species from Ceylon, and some from Mergui. One species only, is found to withstand exposure to frost and snow, the *Limonia lauriola*, Wallich (Pl. As. rar,) which is found onthe tops of cold and lofty mountains, where it is for some months of the year buried under the snow.

Properties and Uses. The properties of the orange in all its protean forms of lemon,

lime, citron, pumplemose, bergamot, &c. are too well known to require notice here, but it is not generally known, that the pulp of the wood-apple (*Feronia elephantum*) affords a very pleasant jelly, so closely resembling black currant jelly that it is only to be distinguished by a slight degree of astringency which it communicates to the taste. In common with that of most of the order, the wood of this tree is very hard and durable, and not the less valuable for being found in most parts of India. The tree itself, is tall and handsome, with a straight trunk and a fine head, but the branches do not spread much. *Ægle Marmelos* equally attains the size of a considerable tree. I have not heard of the wood of this plant being used as timber, probably owing to the respect in which the fruit is held by the Hindoos. It is most frequently met with in pagoda gardens, the following extract from Roxburgh's Flora Indica, vol. 2 page 580, will explain the reason of the preference given to this species.

" This is the Bilva or Matura of the Asiatic Researches, vol. 2 page 349, from whence the following is an extract. ' Uses. The fruit is nutritious, warm, cathartic; in taste delicious, in fragrance exquisite; its aperient, and detersive quality, and its efficacy in removing habitual costiveness, have been proved by constant experience. The mucus of the seed is for some purposes a very good cement.' Note—' This fruit is called *Shreephula* because it sprang, say the Indian poets from the milk of Shree, the goddess of abundance, who bestowed it on mankind at the request of Jowarra, whence he alone wears a chaplet of Bilva flowers, to him only the Hindoos offer them; and when they see any of them fallen on the ground, they take them up with reverence, and carry them to his temple.'

The root, bark, leaves, and flowers are reckoned refrigerants by the Malabar physicians. The ripe fruit they esteem most wholesome."

As an ornamental garden shrub the *Murraya exotica* is much cultivated in this country, and well merits the distinction both on account of the beauty of the shrub itself, and the profusion and fragrance of its flowers; as a cultivated plant it rarely produces seed. *Murraya paniculata* which seems scarcely distinct is frequent in our jungles. The oranges, limes, and pumplemoses, are frequently cultivated in this country on account of their fruit, but the former very rarely with success on the plains, in Coromandel. The cause of this want of success is not ascertained, but I am myself disposed to attribute it to the heat being too high during the period of their ripening their fruit, for it is well known, that in the valleys at the foot of the Ghauts where the cold is much greater during that season of the year, they arrive at great perfection.

The red, loose skinned orange, which arrives at so great perfection in the alpine tracts of the Circars, and which is equally found on the mountains of the south, (but very inferior) is so very tenacious of an alpine country, that it has in the Circars received the name of *hill orange*. This, to my taste, when in perfection, is by far the most delicious of the whole tribe, but judging from the nature of the climate in which it is said to arrive at its greatest perfection, (a cold very humid atmosphere) it seems next to impossible to rear it successfully on the plains. It must be recollected, that the orange for the most part ripens its fruit during the cold season, showing that to attain perfection it requires a considerable range of the thermometer, the heat in their favourite valleys being high during the day, but low during the night, supplies this desideratum. I may here mention on the authority of the late Dr. Turner that the juice of the lemon, lime and citron, contains a large quantity of citric, and that of the orange malic acid.

Respecting the other species of the order a few words will suffice. Dr. Ainslie Mat. Ind. vol. 2 page 86-87, speaks very favourably of the medicinal properties of *Ægle marmelos* under the name *Cratæva*, adding however, that he has never seen the species, which is rather remarkable as it is to be met with in almost every pagoda garden. He informs us that a decoction of the bark of the root is considered on the Malabar coast a sovereign remedy against various forms of disease originating in indigestion, and that the fruit, a little unripe, is given in diarrhæa and dysentery: and Roxburgh (cor. plants) states that the Dutch in Ceylon prepare a perfume from the rind.

The leaves of the *Bergera Königii* which are very fragrant, are much used by the natives as a seasoning for their curries, and are supposed stomachic and tonic. An infusion of the dried leaves is said to stop vomiting.

The young leaves of *Feronia elephantum* have a delightful fragrance resembling anise, hence they are considered stomachic and carminatine. From wounds in the bark of this tree a very transparent gum exudes, having the properties of gum arabic, and is said to be better suited than it, for mixing colours for the painter.

Remarks on Genera and Species. The genera of this order are few, but require much nicety, and attention to minute organs, for their accurate discrimination; the structure of the ovary, which in most is very small, and the number and position of the ovules in its cells, affording the marks on which the greatest dependence can be placed, accordingly form the basis of our characters. The following synoptical table which I extract from our Prodromus will place this in a clear point of view. It contains an analysis of all those having stamina twice as numerous as the petals and a definite number of ovules in each cell of the ovary.

Ovules solitary, or 2 collateral in each cell. Limo-neæ.		
Ovary cells as many as the petals:		
Filaments combined..	1.	*Atalantia.*
Filaments distinct.		
Stamens 6;..	2.	*Triphasia.*
Stamens 8-10.		
Style elongated; (ovules 1-2 in each cell)............	3.	*Limonia.*
Style short, scarcely distinguishable: (ovules solitary.)	4.	*Glycosmis.*
Ovary cells fewer than the petals:		
Style short, scarcely distinguishable; ovules 1-2 pendulous from the apex of the cells.............	5.	*Sclerostylis.*
Style elongated; ovules solitary, peritropal, attached to the middle of the axis........................	6.	*Bergera.*
Ovules in pairs, one above the other. Clauseneæ.		
Filaments distinct:		
Ovary cells fewer than the petals........................	7.	*Murraya.*
Ovary cells as many as the petals;		
Ovary hirsute; berry full of liquid; flower-buds angled	8.	*Cookia.*
Ovary glabrous; berry dryish; flower-buds not angled;		
Stamens 8, dilated part of filaments concave; petals oval..	9.	*Clausena.*
Stamens 10, filaments flat; petals linear-lanceolate...		*Micromelum.*
Filaments (8) combined to the middle: (anthers linear: ovarium 2-3-celled: style long: berry 2-3-celled with a resinous pulp: calyx tubular: petals 4.)............		*Luvunga.*

Of each of these genera, except the two last, detailed characters are given in the work; of them no Peninsular species have, so far as I am aware, been yet found. The plant which I have here, I now find erroneously, referred to *Micromelum*, differs widely in habit, though in structure it associates in many points, as may be seen by comparing the figure, with the character given in the table of the ovary and flowers of that genus,—but I shall add to this account of the order the detailed generic character of *Micromelum* as given by Blume. Though I have not yet found *Luvunga* I will also, to facilitate its recognition should it be met with, extract Roxburgh's description of the flowers of his *Limonia scandens*, which is referred to this genus. Of the genus *Sclerostyles*, of which it was remarked when we wrote, that Dr. Berry was the only person who had found it in the Peninsula, I have now specimens received from Malabar, Courtallum, Ceylon, and the Circars. Whence it would appear that so far from being so rare a genus as we then supposed, it is on the contrary but little if at all less frequent than *Atalantia;* to which it bears so close a resemblance, that it is quite impossible to distinguish them with certainty otherwise than by an examination of the ovary or fruit, the 2 or 4 cells of which immediately marks the difference. (See Icones No. 71,) Of the genus *Glycosmis* I now possess one or two species in addition to those described in our Prodromus, but for which I find it difficult to assign characters suited to distinguish them from the preceding ones. This, of all the genera of the order, next perhaps to *Citrus*, is the most difficult to distinguish by written characters. To the genus *Atalantia* I now add one species and take away another: our *Atalantia racemosa* being in truth a *Sclerostylis*. The new species is distinguished from the old, by wanting the style and having the broad stigma adherent to the apex of the ovary; in all other respects it resembles the other. In his "Pugillus Plantarum Indiæ Orientalis" Dr. Arnott has given the character of a new genus of *Aurantiaceæ* under the name of *Rissoa*. This genus, judging from the characters only, I fear I cannot adopt, as I see no sufficient mark by which to distinguish it from *Sclerostylis*. *Luvunga* differs from both in having superposed not collateral ovules, but in other respects the characters are very nearly alike. Respecting the genus *Citrus* I have nothing to add, to what we have already said in the Pro-

dromus, I have I acknowledge, found both wild limes and oranges in the course of my botanizings, but unfortunately did not devote, at the time, that degree of attention to their examination, relative to the solution of the question of species and varieties of this complex genus, which I ought to have done, and my specimens do not now enable me to do so. Mr. Royle is of opinion that Dr. Buchannan Hamilton, whose views we adopted, is wrong in considering all the Indian forms varieties only, of one species. I extract his paragraph on the subject as being the most satisfactory method of stating his opinion. See his Illustrations page 129.

"So great a diversity of opinion being entertained respecting the different plants of the genus *Citrus*, whether they should constitute species or varieties, it becomes difficult to say what are such, if only seen in a state of cultivation; but as some are still found wild, an opinion may be formed, at least respecting those. In the tract of forest so frequently alluded to, as well as in the valleys within the Himalaya, I have seen two plants growing apparently wild, one called *bijouree*, and the other *biharee nimboo*; the first having the characteristics of the citron, and the other, called also *puharee kaguzee*, those of the lemon: both when transferred to gardens retain their peculiar characters. From the Rungpore forests a round kind of lime is obtained: in those of Silhet, and as it is stated also on the sides of the Neelgherries, the orange is found wild. Captain Turner describes the oranges as delicious, and Mr. Saunders, who accompanied him, mentions finding many orange and lime trees at the foot of the hills in approaching Buxedwar (v. Turner's Tibet; p. 20 and p. 387). *Citrus decumanus* Shaddock or Pompelmoses, does not appear indigenous to India, as its name, *batavi nimboo* or *Batavia lime*, denotes, as remarked by Dr. Roxburgh, its being an exotic; and as it retains its characteristics even where it does not succeed as a fruit, it may also be reckoned a distinct species. I therefore feel inclined to consider as distinct species, the orange, lemon, lime, citron, and shaddock, without being able to say whether the sweet kinds should be considered varieties of the acid, or ranked as distinct species."

That both oranges and limes are found in an apparently wild state in our alpine jungles, is most certain, and it is equally certain that in other, not cultivated, genera, less obvious differences than the fruit, of these plants presents would be esteemed conclusive evidence of their being specifically distinct, whence, I have no intention of calling in question the opinion advanced in the above quotation, my only regret now being, that I did not give the subject more of my attention when I had better opportunities of determining the point.

The following detailed generic character of *Micromelum* is taken from Blume's Bijdragen, vol. 1st. page 137.

Micromelum Blume.—Calyx urceolate, entire, persistent, petals 5, linear spreading. Stamens 10, free: filaments subulate, alternately shorter: anthers roundish, didymous. Ovary 5-celled, cells 2 seeded, (superposed) style thick, stigma obtuse, berry dry, lamellated within, with 5 intorted (spirally twisted) papery dissepiments. Testa of the seed, (spermodermis) membranaceous. Cotyledons, foliaceous, twisted.

A tree with unequally pinnated leaves, alternate, oblique, leaflets, and terminal corymbs.

One species only was known to Blume, namely, *M. pubescens* having from 7 to 9 ovate, obtuse, acuminate, leaflets, the under side of which with the young shoots and corymbs are clothed with pubescence.

It will appear from this character that the habit of the plant which I have figured, as a doubtful *Micromelum*, which is a scandent armed shrub with simple leaves and axillary flowers, differs widely from the true one, so much so indeed, that had I then been acquainted with the true *Micromelum* I should never have thought of referring it to that genus, even under the protection of a doubt. Since the figure was printed, I have had an opportunity of examining a true *Micromelum* and find it differs from my plant in another and much more important point, to which, when naming it, I did not sufficiently advert in the written character, namely, the intorted or twisted partitions of the fruit, and even of the ovary when but little advanced. Thus differing in structure, and so widely in habit I can no longer hesitate in considering this plant as forming the type of a new genus intermediate between *Micromelum* and *Luvunga*: having the quinary flowers and 5-celled ovary of the former, (but wanting its erect arborious habit, and the spiral partitions of its impregnated ovarium and fruit,) and the scandent habit of the latter; (but wanting its 3-celled ovary and quaternary inflorescence.) My first thought, on discovering that it could not possibly be received as a *Micromelum*, was to refer it to *Luvunga* with a modified generic character. The character of *Luvunga*

is to have quaternary sepals and petals, 8 stamens, and a 3-celled ovary, with 2 superposed ovules in each. To admit my plant it would require to stand thus—Calyx 4-5 lobed, petals 4-5. Stamens 8-10, free or united at the base Ovary 3 or 5-celled, with 2 superposed ovules in each. Scandent armed shrubs, with ternate, or simple leaves, and axillary solitary, or racemose, " pretty large, white, fragrant flowers" (Roxb.) Such a union is however very objectionable as combining two plants, one with the number of petals and cells of the ovary equal, and the other with them unequal. I therefore pursue what I consider the more judicious course, that of forming a genus for the reception of this plant.

Luvunga.—Hamilton.—The following is Roxburgh's description of the fructification of his *Limonia scandens*, now *Luvunga*, Flora Indica, 2 page 380. " Calyx 1-leaved, cylindric with the mouth cut into four short, truncate divisions. Petals 4, linear oblong, fleshy, recurved. Filaments 8; the lower half united into a firm, fleshy tube. Anthers linear, incumbent. Germ conical, elevated on a fleshy receptacle, 3-celled with 2 vertical ovula in each, attached to the axis. Style cylindric. Stigma entire, roundish. Berry oblong, somewhat 3-lobed, size of a pigeon's egg, pretty smooth, pulp of a resinous nature, and odoriferous, 3-celled. Seed solitary, oval, somewhat pointed at the apex, covered with a single greenish-veined integument. Perisperm none. Embryo conform to the seed, inverse. Cotyledons oblong, green, fleshy. Plumula 2-lobed. Radicle ovate, superior."

Two species of this genus are named in Wallich's list, namely, *L. scandens* and *L. Tavoyana*—Roxburgh thus characterizes the former, his *Limonia scandens* " Shrubby, scandent, armed, leaves ternate, leaflets lanceolar, entire: [flowers racemose,]: berries 3-seeded" Roxb.

The following character will I think distinguish my new genus from all the others of the order.

Paramignya R. W.—Calyx urceolate, obtusely 5-lobed at the apex. Petals 5, lanceolate. Stamens 10, free: filaments compressed, subulate at the point: anthers oblong, obtuse, attached by the back. Torus fleshy, cup-shaped, lobed at the apex; embracing the base of the ovary. Ovary obtuse. 5 celled, partitions fleshy, not twisted. Ovules 2, superposed, in each cell, attached near the middle of the axis. Style thick, length of the stamens. Stigma capitate, obtuse, somewhat lobed at the apex. Fruit pomacious! endorcarp 5-angled. between coriaceous and fleshy, surrounded by cellular pulp and rind, one (always ?) celled by the rupture and absorption of the partitions. Seed.—Scandent, armed shrubs; spines axillary reflexed. Leaves simple, ovate, lanceolate, acuminated, glabrous. Flowers axillary, solitary, or rarely 3 or 4 together, rather large, white, very fragrant. The fruit ovate, obtusely 5 angled and furrowed between, clothed with short matted pubescence, the seed I have not seen.

The scandent habit, associates this genus with *Luvunga*, from which it is removed by the symmetrical petals and cells of the ovary, the predominance of the quinary not quaternary number of parts, and the free not united filaments, but above all, by the distinct endocarp of the fruit. I first found it in the jungles about Courtallum its long decumbent branches, spreading in all directions among the surrounding bushes, forming a nearly impenetrable brush-wood; I afterwards received fine specimens through the kindness of Colonel Walker from Ceylon, and very recently one in fruit, but in a bad state for examination, from Mr. Nimmo, of Bombay. This last is the only fruit I have seen.

Only one species is yet known, the one here figured—It varies however in having larger, and more decidedly ovate leaves, and smaller thorns, differences depending I apprehend on luxuriance only.

The species of *Micromelum* the examination of which enabled me to determine, that the above was really a distinct genus, is a native of Ceylon, and does not seem to differ from Blume's *M. pubescens*.

ATALANTIA.

The following brief characters will sufficiently distinguish my two species of *Atalantia*.

A. monophylla DeC. Style as long as the stamens, stigma subcapitate, lobed.

A. platystigma. R. W. Style wanting, stigma large, flat, appressed to the apex of the ovary.

The habit and general appearance of both plants are the same.

GLYCOSMIS.

I mentioned above, that I had met with what I consider a new species of this genus. The following character may perhaps suffice to distinguish it from the preceding species.

Roongiah del.

LIMONIA ALATA

Winchester. Lith.

S. macrocarpa. R. W. Shrubby, leaves pinnate, leaflets 3-5, oblong, lanceolate, attenuated at the base, acuminated above, quite entire: panicles terminal, corymbose small: fruit globose, about the size of a cherry, contracted at the base into a short podocarp.

Courtallum in dense jungles.

The large size of the fruit forms the best distinguishing mark: in all the other species it scarcely exceeds the size of a pea, in this it is as large as a moderate sized cherry.

SCLEROSTYLIS.

Of this genus there appears to be several species, all of which seem hitherto to have been confounded with *Atalantia.* Among my specimens I find the following series of forms each of which may perhaps be considered distinct species—and all distinct from Roxburgh's *Limonia bilocularis* our *S. atalantioides.* Taking that species as the original type of the Indian branch of the genus, it is distinguished from the following by having fascicled, subsessile, axillary and terminal, quinary, flowers: *i.e.* the calyx, 5-lobed: the corolla 5-petaled: and 10 stamens; filaments free, not united.

From this character all the other Indian and Ceylon ones with which I am acquainted depart in having quaternary flowers, some still further recede by having the filaments united into a tube as in *Atalantia.* Taking these marks as so many points of distinction the genus may be thus subdivided.

* Flowers quinary.

S. atalantioides W. and A.

** Flowers quaternary.

† *Filaments cohering into a tube.*

S. racemosa (R. W.) Thorns large, leaves ovate, more or less emarginate, racemes axillary, simple or branched: flowers villous, subsessile, petals 4, stamens 8, filaments united to near the apex, into a tube, ovary 2 or 3-celled, fruit globose.

Atalantia racemosa (partly) W. and A. Prodromus, page 91.

S. parvifolia (R. W.) Sparingly armed, leaves narrow, elliptic, oblong, slightly acuminated and emarginate at the apex, racemes axillary, solitary, or paired, about as long as the leaves, flowers rather remote, longish pedicelled, segments of the calyx pointed, petals reflexed, filaments united into a tube, fruit globose, small.

Atalantia racemosa (W. and A.) partly.

This in the size and form of its leaves seems very nearly allied to Roxburgh's *Limonia bilocularis,* but differs in having racemose quaternary, not fascicled quinary flowers.

S. ovalifolia R. W. Leaves broadly oval, attenuated at the base, very slightly and obtusely acuminated at the apex, racemes axillary, short, few flowered. Flowers short, pedicelled, filaments united to the apex; ovary 3 (always ?) celled, stigma clavate.

†† *Filaments compressed free.*

S. Arnottiana R. W. Armed, or occasionally without thorns, leaves ovate, very broad and rounded at the base, acute, or somewhat obtuse, and slightly emarginate at the apex, flowers axillary, fascicled, pedicels 1-flowered, or rarely 2 or 3 flowered, filaments free to the base, compressed, suddenly attenuated at the point, anthers cordate at the base, stigma clavate.

Ceylon.—Colonel Walker.

The broadly ovate short petioled leaves and congested flowers, afford the best marks by which to distinguish this from the following.

S. Ceylanica. Leaves oval, attenuated at the base, very obtuse and entire, or slightly emarginate at the apex: racemes axillary, solitary, about half the length of the leaves, many flowered, (20 to 30) flowers longish, pedicelled, filaments free, much compressed, or somewhat winged, anthers cordate at the base, stigma clavate.

Ceylon.

One or other of these or perhaps both go to form, I think, Dr. Arnott's *Rissoa ceylanica.* So far as my specimens enable me to judge they ought to be kept separate. In addition to these 5 species I have specimens of another from Malabar, but being in fruit only, I refrain from introducing it here. I may observe in conclusion that it appears to me the whole genus requires further revision.

MICROMELUM.

The only specimen I have seen of this plant closely resembles Bergera Königii in form. It is every where clothed with short white pubescence, the leaves are pinnate, leaflets 7-11, ovate, acuminate, blunt, emarginate, somewhat oblique at the base. Flowers small, numerous, forming large terminal corymbs, the ovary thickly covered, with longish white hairs. Should this on comparison with the Java plant be found to differ, I would recommend its being called *M. Ceylanica.*

PARAMIGNYA.

P. monophylla. Of this plant I have seen two varieties, but not sufficiently distinct to admit of their being considered species.

EXPLANATION OF PLATE 41.

1. Limonia alata---*natural size.*---2. A flower expanded.
3. Stamens.
4. Ovary, style and stigma, the calyx partly removed to bring them into view.
5. Ovary cut vertically, showing the pendulous collateral ovules.
6. The same cut transversely to show its 5 cells.
7. A full grown fruit.
8. A seed.---9. The same cut transversely.
10. The testa removed, one of the seed lobes showing the embryo next the hilum---*all more or less magnified.*

EXPLANATION OF PLATE 42.

1. Paramignya monophylla, R.W. (Micromelum? monophyllum)—*natural size.*
2. An expanded flower.
3. The same, the calyx partially separated and the petals and stamens removed, to show the cup-shaped plaited torus, ovary, style, and stigma.
4. Stamens and anthers, filament compressed, subulate at the apex.
5. The 5-celled ovary cut transversely.
6. The same cut vertically, showing the ovules superposed.
7. A portion of a leaf magnified, to show the pellucid dots.

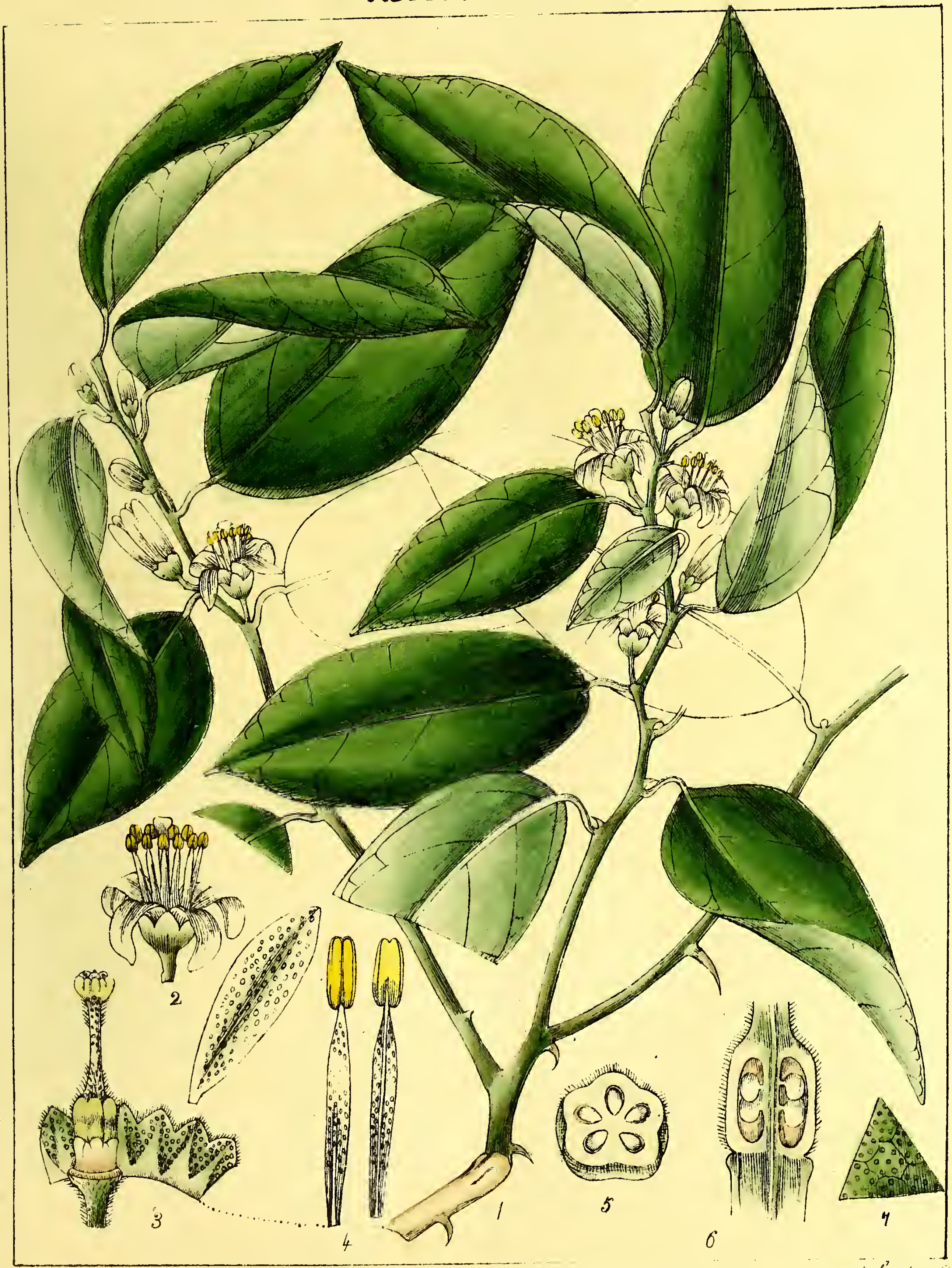
XXXII.—HYPERICINEÆ.

In proportion to the extent of its distribution over the surface of the earth this is a small order, about 160 or 170 species being all that is yet known, though found in every quarter of the globe. Its forms are about as varied as its distribution, consisting of herbs, shrubs, and trees. The juice is usually resinous, often yellow, resembling that of the *Guttiferæ:* the stem in most, and the branches in nearly all, have swollen articulations, and are 4-sided in the intervals between the joints. The leaves are opposite, simple, entire, or crenulated; with marginal glands; sessile, or attenuated into the petiols, for the most part perforated with pellucid glandular points, the margins sometimes marked with black opaque dots. The flowers are regular, bisexual, often forming terminal dichotomous cymes, and usually yellow.

Calyx persistent of 4-5 sepals imbricated in æstivation. Petals hypogynous, twisted in æstivation, obliquely veined, as many as the sepals, alternate with them, usually withering, becoming, after anthesis (blowing) variously twisted or involute on the margin in different species. Stamens indefinite 3-5 adelphous, rarely monadelphous, or quite distinct. Anthers versatile, dehiscing longitudinally. Ovary solitary, consisting of 3-5 united carpels, 3-5 celled, cells with numerous ovules. Styles as many as the carpels, distinct or connate. Stigmas simple or capitate. Fruit baccate, or capsular with several valves, and a septicidal dehiscence, usually several celled with the placentæ in the axis, sometimes 1-celled with the placentæ, parietal. Seeds minute, indefinite, or few, in each cell, albumen none. Embryo straight, radicle next the hilum.

Affinities. The relationship existing between this order and *Guttiferæ* seems to be universally admitted, as in all systems of Botany they are placed near each other, but yet the differences seem so manifest, that it appears next to impossible to confound them. This I am disposed to attribute to the circumstance of their most striking points of affinity appertaining rather to the products of vegetation and properties than to their botanical characters, *i. e.* the structure and arrangement of the parts of fructification: which are sufficiently distinct in the two orders. The capsular, few celled polyspermous fruit, of *Hypericineæ*, can scarcely be mistaken for the baccate indehiscent few seeded pulpy orange-like fruit of the *Guttiferæ*—exclusive of which the quinary, not dinary or quaternary disposition of the flowers, form another very marked distinction: in a word, considered with reference to the structure of their inflorescence only, the marked affinity found to exist between the two orders is only perceptible in extreme cases, while the differences observed in the character of the fruit of different genera, renders it difficult to say to how many other orders they approach.

Geographical Distribution. Few orders of the same extent have an equally general distribution over the surface of the globe; every quarter partaking more or less extensively. India, and the adjoining islands, judging from Wallich's list participating, with the exception of North America, more largely than any other, 31 Indian ones being there enumerated, while 41 is the number set down for the whole of North America, and 19 for Europe. The Peninsular Flora however, so far as is yet known, boasts of very few, four or five species only having been discovered, and all from the more elevated regions. These, according to a recent exposition of the order by M. Spach, (*Annales des Sciences Naturelles*) are referred, and on good grounds, to two distinct genera, *Norysca* and *Brathys*, the former including our *Hypericum mysurense* and *Hookerianum*, the latter *H. japonicum* and *Wightianum*, which for the future will respectively be called *Norysca mysurensis* and *Hookeriana*, and *Brathy's japonica* and *Wightiana*. The characters of these genera will be afterwards given.



Kungia del

MICROMELUM ? MONOPHYLLUM . P.IV

Winchister Lith.

Properties and Uses. These were formerly believed to be of the most valuable description, but modern experience does not confirm the ancient belief. One species, *Hypericum androsæmum* once enjoyed so prominent a reputation on account of its supposed sanative properties as to receive the name of *All heal*, and hence the English name *Tutsan* from *Toute-saine*, on the supposition that it cured all diseases and wounds, but, notwithstanding, has now fallen into total neglect. Many species when rubbed between the fingers exhale an aromatic resinous odour which is communicated by infusion to alcohol and oil, imparting to them a reddish colour; and appears referable to a resinous principle which they contain. They also contain a gummy matter in greater or less abundance. Some of the American species abound in a yellow juice, possessing more energetic properties "that obtained from *Vismia guineensis*, a Mexican and Surinam tree is known in commerce, and called American *Gummi gutta* (or gamboge)" *Royle's Illustrations*. So far as the Indian species are concerned nothing is known of their properties.

Remarks on Genera and Species. Previous to the investigations of M. Spach the number of genera referred to this order amounted to 12 only. These under his scrutiny have been augmented to 27: species of 23 of which were formerly united under the large and very complex genus *Hypericum*. To give a complete view of this order as it now stands, would require more space than can be here devoted to the subject, I shall therefore content myself for the present with giving some of his sectional characters, and the generic characters of a few of the genera which we either already know, or may expect to find, in India. Species of both the Peninsular genera I have now figured, viz. *Norysca mysorensis*, Icones No. 56, and *Brathys Wightiana*, No. 43 of this work under the old name *Hypericum*.

M. Spach divides the order into two principal tribes under the names of Desmostemoneæ and Hypericeæ, which are again subdivided into sections. Of the first tribe, as only a few species seem referable to the Asiatic Flora and none of these strictly speaking Indian, being natives of the eastern islands or China, I shall only give the character with one of its sections, and one genus, which I have had an opportunity of examining, and pass on to the second, which, as being of more importance to the Indian Botanist will be more fully explained.

Tribe 1st.—Desmostemoneæ.—Petals equal sided, within, above the base, very often furnished with a little pit or appendage. Stamens triadelphous or pentadelphous, the androphore (united portion of the filaments) longer than the filaments, or very rarely shorter: each alternating with a gland or hypogynous scale. Pericarp often fleshy or drupacious. Seeds usually compressed or winged, the radicle sometimes replicate.

Section 2.—Tridismineæ Sp.—Stamens persistent, 3 adelphous; androphores polyandrous, longer than the filaments, with a coriaceous scale alternating. Ovary 3-celled, 3-styled, with the ovules definite, or indefinite in number, ascending, winged! Pericarp capsular, (the central axis wanting or slender) often loculicidal! Seeds cylindrical, broadly winged above; Embryo straight. Trees or shrubs, corolla often white or reddish.

Ancistrolobus Sp.—Sepals erect, persistent. Petals subpersistent, inappendiculate. Hypogynous scales convolute. Androphores strap-shaped, filamentiferous, nearly from the base; anthers reniform, eglandular. Ovary, cells with 5-6 ovules; ovules attached to the base of the cells. Style, thicker above. Stigmas capitate, papillose. Capsules coriaceous, oblong, roundish: cells few seeded, partitions cartilaginous, placentiferous at the base. Seeds oblong, smoothish: wings reticulated, margined with a nerve; cotyledons as long as the radicle, hooked at the apex. Peduncles, axillary and terminal, 1-5 flowered.

Of this genus I have had an opportunity of examining one species from Mergui, for which I am indebted to W. Griffith, Esq. It is not improbable that it may prove new, but as I am unacquainted with the rest of the genus I refrain from naming it.

The plant is a tree or shrub with slender terminal branches, glabrous, the leaves oblong, elliptical, obtuse at the apex, slightly attenuated at the base, gradually tapering into the petiol, the larger ones from 3 to 4 inches long and about $1\frac{1}{2}$ broad, those having flowers in their axils scarcely half the size. Flowers axillary, solitary, short petioled. Sepals and petals rounded and obtuse above, the petals slightly oblique at the base. The stamens very numerous, densely covering the back of the ligulate androphores, filaments short, slender, anthers minute. Hypogynous scales, cuniate, saccate at the apex, from the contraction of their reflexed margins.

Cells of the ovary with about six winged ovules, the mature fruit I have not seen—v. s. s. ex. Herb. Griffith, No. 1104.

Tribe 2d.—Hypericeæ.—This tribe is characterized by having petals unequal, or rarely, nearly equal sided, (without pits or appendages at the base) and usually contorted in æstivation. Stamens either altogether free, or monadelphous, or 3-5 adelphous at the base. Hypogynous scales or glands, sometimes wanting. Pericarp (very rarely indehiscent) a septicidal capsule, or sometimes composed of three deciduous indehiscent cocci. *(vel rare dieresilis* tricocca)* Seeds terete, wingless, often somewhat curved: radicle terete, elongated, obtuse, never replicate; cotyledons somewhat foliaceous, very short.

This tribe is divided into five sections, the characters of each of which I shall introduce.

Section 1.—Drosanthineæ.—Calyx, 5-cleft or parted. Petals equal, or nearly equal-sided, unguiculate, marcescent (withering in the flower without falling off) twisted after expansion, (anthesis). Ovary 3-celled, 3-coccus, 3-styled. Ovules horizontal or ascending, definite or indefinite in number, (6-12 in each cell) the mature cells 1-3 seeded, at length deciduous, along with the central placenta.—To this section two genera belong, neither of which however, has yet been found in India, all the species hitherto discovered, being from Persia or Asia Minor.

Section 2.—Hyperineæ.—Calyx, 5-parted or cleft, (very rarely, five distinct sepals in a double series). Petals marcescent, unequal sided, convolute, or contorted after anthesis (blowing). Stamens 3 adelphous, persistent. Ovary 3-celled, many ovuled, 3-styled. Capsules septicidal: central placenta undivided, and with the valves persistent.—Three genera are referred to this section, but only one of them so far as I know, has representatives in India. To this section belongs the greater part of the European species of the order.

Section 3.—Androsœmineæ.—Sepals 5, most frequently in a distinct double series, and very unequal. Petals withering or deciduous, unequal sided, after anthesis contorted, or the margins convolute. Stamens pentadelphous, (very rarely, 4-6 or 8 adelphous, or monadelphous, at the extreme base) withering, or deciduous. Ovary, 3-5 (rarely 6-8) celled, many ovuled. Styles equalling the number of the cells, often united towards the base, or even nearly to the apex. Capsules septicidal, very rarely baccate, or indehiscent —To this section seven genera belong, all separated from the old genus *Hypericum*, one of these is *Norysca.*

Section 4.—Brathydineæ Sp.—Sepals 5, (very rarely 4) petals deciduous or withering, and after anthesis, involute from the apex to near the middle, unequal sided. Stamens either altogether free and deciduous, or monadelphous at the base and then withering. Ovary, one or 3-celled, 3 (rarely 2) styled, sometimes the styles altogether concreted as if one styled, ovules numerous. Capsules 2-3 valved.

This section includes four genera, one of which is Brathys.

Section 5.—Ascyrineæ Sp.—Sepals 4, distinct in a double series, cruciate; the two exterior large, (one above the other below), during flowering, and after anthesis valvate: two interior (lateral) very small (sometimes scarcely conspicuous) included. Petals 4, cruciate unequal, and unequal sided. Stamens persistent, somewhat monadelphous at the base, ovary 1-celled, 2-4 styled.

To this section only one genus *Ascyrum* is referred.

The following genera are known to exist in India, on which account I shall introduce Spach's generic characters.

Hypericum.—*Section Hyperineæ.* Calyx 4-5 parted, sepals equal or unequal, after anthesis, erect, very rarely reflexed. Petals marcescent, scarcely unguiculate, spreading horizontally during flowering. Androphores bearing from 5 to 30 stamens. Ovules in each cell, in two

* I am uncertain about the exact meaning attached to this word, but presume the author wishes to express a fruit analogous to that of *Geraniaceæ*. That consists of a series of indehiscent carpels, which separate entire, with their seed inclosed at the period of maturity, leaving the central axis or gynobase to which they were articulated in its place.

HYPERICUM WIGHTIANUM (*Wall.*:)

or four series. Stigmas pointed or subcapitate. Capsules cartilaginous or papery, (rarely coriaceous) for the most part tri-cephalous, placenta nerve-like, or pyramidal, 3-sided—Mr. Royle found *Hypericum perforatum* on the Himalayas, and it seems not improbable other species may be found.

Norysca Sp.—*Section Androsæmineæ.*—Sepals coriaceous, nearly equal, erect after anthesis. Petals somewhat knife-shaped, obliquely acuminated, deciduous. Androphores 5, very short, deciduous. Ovary, 5-celled. Styles 5, often united to near the apex. Stigmas minute, suborbiculate. Capsule 5-celled, somewhat coriaceous, placenta pyramidal, 5 sided, 5 crested, (the crests bearing the seeds) persistent. Seed minute, straightish.

To this genus our *Hypericum mysorense*, Prod. 1, page 99, belongs (*N. mysorensis*, Wight's Icones, No. 56, *N. myrtifolia?* Spach) and *H. Hookerianum*, perhaps also, several of the Himalayan species.

Brathys. Mutis and Spach.—*Section Brathydineæ.*—Sepals 5, unequal, or about equal. Petals, hatchet-shaped (dolabriformia), cuspidate, withering, involute after anthesis! Stamens somewhat definite in number, (9-30, rarely 5) or indefinite, (40-100) persistent. Ovary, 1-celled. Styles 3, (rarely 4-6) straight or recurved, distinct. Stigmas thickish, subcapitate. Capsules papery, or sub-coriaceous, 1-celled, 3 (rarely 4-6) valved, placentas filiform, or nerve-like.

To this genus our *Hypericum japonicum* and *Wightianum*, (the plant here figured) and an intermediate form, perhaps a species, lately found in Mysore by Lieut. Munro belong. Of this last, my specimen does not enable me to determine whether it is really a species or only a luxuriant variety of *B. japonica.* It appears to be a much larger plant, has two stipitate glands on each edge of the sepals, and the margins of the leaves are furnished with a row of black dots. In our characters of both *B. japonica* and *Wightiana*, it is particularly mentioned that the leaves have not black dots, which led Mr. Munro to conclude that this one was certainly new on account of its having them. On looking for them, I found that the black colour had faded in drying leaving very pale brown spots, only to be observed by the most careful examination, similar ones are sometimes, though not always found on the leaves of both the others, whence I conclude this is a character of no value from its not being constant even in the same species, nor even on all the leaves of the same plant: the stipitate glands of the calyx, I think, a better character. The minute and copious analysis of *B. Wightiana* in the accompanying figure will afford a correct idea of the characters of the genus, and if compared with those of *Norysca*, will prove, that, it is not without good reason the overgrown and polymorphous genus *Hypericum* is broken down. I acknowledge that, judging from characters only, I think some of M. Spach's genera are made to rest on points of perhaps too trivial importance, but generally, I believe, it will be found we are great gainers by his labours, for previously a more unsatisfactory genus to examine scarcely existed in the vegetable kingdom.

P. S.—After this account of *Hypericineæ* was written and partly in type, I was led in the course of my examination of *Guttiferæ*, to the very unexpected conclusion, that the genus *Xanthochymus*, could not be retained in that order, and that, with the exception of the seed alone it is much more justly referable to the tribe *Desmostemoneæ* of this order, than to *Guttiferæ.* My reasons for adopting this opinion will be explained while treating of *Guttiferæ*, and will I think fully establish its correctness, and at the same time still further prove the intimate relationship existing between these two orders.

EXPLANATION OF PLATE 43.

1. Brathys (Hypericum) Wightiana—*natural size.*
2. An expanded flower.
3. Anthers.
4. The ovary somewhat advanced cut transversely, showing it 1-celled with 3 parietal placentæ.
5. A fruit nearly mature—*natural size.*
6. The same magnified.
7. The mature fruit after dehiscence, showing the manner in which the valves separate from the placentæ.
8. A seed.
9. The same cut transversely.
10. The testa removed.
11. The embryo.
12. A portion of a leaf magnified, to show the pellucid dots—*with the exception mentioned—all more or less magnified.*

XXXIII.—GUTTIFERÆ.

This is a small, strictly tropical, order, few being found to extend even a very few degrees beyond the tropics. For the most part it consists of trees, many of considerable dimensions, abounding in yellow resinous juice, that of some of the species, forming the well known Gamboge of commerce. The leaves are opposite, coriaceous, usually short petioled, simple, entire, 1-nerved, with numerous transverse parallel veins, and without stipules. The flowers are either hermaphrodite or unisexual, either axillary, solitary, or racemose, or in terminal panicles; occasionally in lateral fascicles.

Calyx free, often persistent, 2-4-6 or 8 sepaled, the sepals often coloured, resembling petals, imbricated by alternate pairs, the exterior ones often larger. Petals hypogynous, as many as the sepals, and alternate with them, or occasionally there are 4 in a 2-sepaled calyx, the outer pair passing insensibly into sepals. Stamens numerous, filaments either distinct, or combined into one, or four parcels, rarely definite; when unisexual, more numerous in the male flowers. Anthers adnate, one, two or 4-celled, bursting either lengthwise, transversely across the apex, or are circumsissile, sometimes, they open by a pore. Disk none, or prolonged in form of a rudimentary ovary in Mangostana. Ovarium solitary, superior, one or several celled, ovules solitary, or several, erect, or attached by the middle to a central placenta. Style none, or short. Stigma peltate, entire, or radiate and lobed. Fruit, either dry or succulent. one or several celled, with one rarely several seed in each cell. Seeds, frequently nestling in pulp, their coat thin and membranous apterous, frequently with an arillus. Albumen none. Embryo straight, cotyledons thick, inseparable: radicle either turned to or from the hilum.

Affinities. These have been already indicated under *Ternstrœmiaceæ* and *Hypericineæ*, the orders most nearly related to this, and the distinguishing marks pointed out: to these therefore I beg now to refer merely observing, that hitherto, so far as my opportunities of examining the Indian representatives of these orders extend, I have found no difficulty in discriminating between them. I do not mean by this to assert that difficulties are not found in distinguishing between these orders as now defined, but simply, that the Indian species seem mostly to appertain to the more marked, and least equivocal forms of each. Some further observations bearing on this subject will be found under the head of 'Remarks on genera and species' below.

Geographical Distribution. This, as remarked above is strictly a tropical order, very few species extending beyond that limit, *Xanthochymus pictorius* being mentioned by Mr. Royle as a remarkable exception, and my *Calophyllum Walkerii* may perhaps be adduced as a second example, for although a native of Ceylon, yet it is found only on the highest parts of the island at an elevation of about 7000 feet. These however can at best be considered as doubtful exceptions to the general rule, that they are confined to low moist localities partaking of a warm and humid climate, since neither can be viewed as genuine members of the order. This prediliction for warmth and moisture satisfactorily accounts for their predominance on the west coast of the Peninsula, where some species greatly abound, as compared with the east where very few species are found, and these very rare, being nearly confined to warm sheltered alpine valleys, enjoying a more humid climate than the plains. The southern provinces of Ceylon, Silhet, the Tenasserim coast, and eastern Archipelago, each partake largely of this order: wherever in short there is high temperature combined with much moisture there they are found. In tropical America they are said to be more numerous than in Asia, this however may be doubted, as it appears from Wallich's list of Indian plants, that including *Xanthochymus* he had no fewer than 40 Indian species; while Mr. Don's system of plants, the last work published giving a complete catalogue of the order, has but 79, and these do not include several Javanese species published by Blume, to which it may be added, we have every reason to believe there are very many yet undiscovered in India and her islands, the Botany of every part of which has been less perfectly investigated than that of many parts of tropical America, though in truth, there is still a rich harvest for the enterprising Botanist in both countries. In continental Africa the order is nearly unknown, but several species are natives of Madagascar and the Mauritius.

Properties and Uses. DeCandolle remarks that without doubt the *Guttiferæ* would prove of great value, both for medicine and the arts, were they not exclusively confined to the warmest climates. As ornamental trees they are certainly not surpassed by any in the vegetable

kingdom, and if we may judge of others from what is known of the Pinney tree *(Calophyllum)* the timber of some at least must be very valuable, but little seems yet known regarding it. Roxburgh generally so attentive to the uses and applications of the plants he describes is altogether silent on this head respecting *Guttiferæ,* contenting himself with the mention of several, the fruit of which is eatable, such as the well known Mangosteen *(Garcinia Mangostana)* the *Garcinia cowa,* of Silhet and Malabar, the fruit of which is " eatable, though not palatable" the *G. Kydiana,* the fruit of which is " an exceedingly sharp but pleasant acid, and the aril or pulp, by far the most palatable part," and lastly, the *Garcinia pedunculata* " the fleshy part of the fruit, which covers the seed, and their proper juicy envelope or aril is in large quantity, of a firm texture, and of a very sharp pleasant acid taste. It is used by the natives in their curries and for acidulating water." As it retains its qualities when cut into slices and dried, he suggests, that it might be advantageously employed on long voyages as a substitute for lemons or limes. The pulp of the fruit of *Garcinia paniculata* he thinks more like that of the Mangosteen, than any thing else he can compare it to. The parched climate of this portion of India renders it unlikely that we shall ever succeed in introducing many of them here: Roxburgh tried in vain for 35 years to make the Mangosteen grow and be fruitful in Calcutta. The attempts made in the gardens of Courtallum have been more successful, for there two or three trees annually ripen their fruit, few in number it is true, but the trees are still young. Plants raised from seed saved from these trees were, I learned some time ago. thriving in Mr. Huxham's plantations in Malabar. From this source therefore, it seems not improbable, the tree will extend along that coast the climate of which appears congenial to the plant.

Of those producing Gamboge, Roxburgh particularly mentions two kinds, namely, *Xanthochymus pictorius* and *Garcinia pictoria.* The juice of the former differs so very widely in its qualities from good Gamboge, that it can never be expected to prove valuable as a pigment, until its chemical constitution is better known than it was to Roxburgh, and measures can be adopted to render it more manageable in the hands of the artist. This result the imperfect analysis of Dr. Christison seems to indicate, is most unlikely, since however well known, it does not possess the elements of Gamboge : a further confirmation of the opinion, expressed above, that it is not a genuine *Guttifera.* That of the latter is described as affording a bright coloured superior Gamboge when recent, but the colour liable soon to fade. The tree or trees, however, which produce the Siam or Chinese Gamboge of commerce is not yet known, though the result of late enquiries on the subject in Ceylon, leave scarcely a doubt, as to it or them being members of this family—neither is the kind of preparation known, which the finer kinds undergo to fit them for the European market. The account given of the course of this article to the European market is, that it is produced in Siam and carried thence to Singapore, whence it is imported into England by the China ships.

The best account we yet possess, so far as I am aware, of the qualities and composition of Gamboge is given in a paper by Professor Christison of Edinburgh, " On the sources and composition of Gamboge, with an examination of some analogous concrete juices" published in the second volume of Hooker's Companion to the Botanical Magazine, the whole of which article I should, had space permitted, have transferred to these pages, as being so much more generally read in this country than the work in which it originally appeared. Some extracts from this masterly memoir I shall however introduce, in the hope that they may lead to still further enquiry both in this country and in the eastern Archipelago, where the tree producing it, is most probably indigenous, and prove the means of putting us in possession of flowering specimens of the plant thereby enabling us to set at rest this long agitated question, viz., what is the tree that affords the Gamboge of commerce?—one Ceylon tree, the one here figured under the name of *Hebradendron Cambogeoides*, has been ascertained to produce a Gamboge, agreeing in nearly all respects with the best Siam Gamboge, whence it is presumed, and on good grounds, that a nearly allied, if not the identical, species is the one that produces the Gamboge of commerce, which it would appear from the enquiries of Dr. Christison is altogether derived from the eastward, none having as yet been exported from Ceylon for the English market.

Of the Ceylon tree, Dr. Graham, Professor of Botany in Edinburgh, has given a very interesting account in the same volume of the Companion to the Botanical Magazine. and shown that it is totally different from the *Stalagmitis Cambogioides* of Murray, the tree hitherto supposed, on most insufficient grounds, to be the source of this very valuable substance.

The following are the extracts, promised above, from Dr. Christison's paper, and which though copious, afford but a very imperfect idea of the mass of information embodied in this lucid and scientific memoir.

"The source of Gamboge has long been a subject of doubt and controversy among Pharmacologists and medical Botanists; nor are the opinions and information, even of the most recent authors, by any means satisfactory. In order to understand this enquiry thoroughly, it is necessary to be in the first instance distinctly aware, what are the articles to which the name of Gamboge is usually given, and whence they are obtained.

In point of fact, a considerable number of kinds of Gamboge, differing more or less from one another in quality, and even in nature, as well as in their place of origin, are known in commerce. The most important and finest qualities are generally considered to come from the kingdom of Siam, and are imported into England from China by way of Singapore. Among these the wholesale druggist distinguishes by name at least two, and generally three varieties—pipe gamboge, cake or lump gamboge, and coarse gamboge. Pipe gamboge, which is invariably the finest, has sold in the London market during the last eight years, at prices varying from two shillings and ten-pence to five shillings a pound, exclusive of duty.* Cake or lump gamboge is sometimes very nearly equal in quality to the last, but is more commonly somewhat inferior, and therefore sells for at least three-pence a pound less. The two qualities are sometimes mixed in the same packages; sometimes each package contains but one; and frequently, on the other hand, the cases contain not merely pipe and cake gamboge, but likewise more or less of a very inferior sort, by the presence of which the price is materially affected. This inferior sort again, of which there are probably many varieties confounded together in the rude nomenclature of the English drug-market under the name of coarse gamboge, and which will be seen presently to be nothing else than a cake gamboge of low quality, often constitutes the entire contents of the package. In its crude state this is quite unfit for the purposes of the painter, and is equally rejected for medicinal use; and consequently it bears so contemptible a character in the market, as to bring scarcely ten-pence a pound, when the other sorts are worth three or four times as much. For this statement I am indebted to Mr. Stead, an extensive and experienced wholesale druggist in London."

"1.—Pipe gamboge is so termed in the nomenclature of the drug-market, from its peculiar form. It occurs chiefly in cylindrical masses, from three quarters of an inch to nearly three inches in diameter, commonly hollow, and often doubled upon themselves, and cohering. Not unfrequently several of these pipes or cylinders are firmly accreted into irregularly-shaped cakes or balls, two or three pounds in weight; in which, however, the remains of the cavities may be traced, though much flattened. The surface of the unaccreted cylinders is dirty greenish yellow, and striated, evidently from the impression of the reed moulds into which it is run when soft. Where several cylinders have been joined together, and squeezed into a cake or ball, the mass is usually wrapped in large leaves, which appear to belong to a malvaceous or bombaceous plant. Pipe gamboge is very brittle, and presents a somewhat conchoidal fracture, the surface of which is smooth, brownish yellow in tint, and glimmering in lustre. It becomes bright Gamboge-yellow wherever it is frayed or rubbed, and very readily forms an emulsion, or paste of the same hue, when rubbed with the wet finger. It has scarcely any taste; but after a short time produces a sensation of acridity, especially in the back of the throat. Neither has it any smell; yet the fine dust, raised in pulverizing it, quickly irritates the nostrils, even in quantities inconceivably minute, exciting a profuse flow of mucous, and some sneezing, but without pain.

This variety of Gamboge is familiarly known to be an excellent and powerful purgative, which in the dose of three, five, and seldom more than seven grains, produces profuse watery discharges; nor has there ever appeared to me any reason for dreading its effects, as our predecessors did; for its action is seldom or never accompanied with much pain or other uneasiness, if it is thoroughly pulverized with some other finely pulverizable substance, such as cream of tartar. Yet on the other hand, it is a dangerous poison in large doses; one drachm has proved fatal; and the cause of death is violent inflammation of the bowels. I believe that the occasionally fatal effects of a nostrum much in vogue in the present day, under the name of Morison's Pills, have been satisfactorily traced to an over dose of Gamboge."

* Martin's History of the British Colonies, i. 224. table.

" The best solvent for separating the resin of Pipe gamboge is sulphuric ether. When agitated with the powder, a lively orange-red solution is obtained, which becomes Gamboge-yellow by dilution, and continues to show this tint when very greatly diluted, proving the exceeding intensity of the colour. On distilling off the greater part of the ether, and then driving away what remains by heating the residue in an open porcelain cup, a very beautiful, brittle resin is obtained, which has in thin layers a deep orange-colour and complete transparency, and in thicker masses a cherry-red tint, so dark as to produce almost complete opacity, and which possesses in fine powder a lively Gamboge-yellow hue.* It is remarkable that the very volatile fluid, sulphuric ether, adheres with great force to this resin, insomuch as to be the source of much trouble, and even error in a quantitative analysis. The vapour-bath heat of 212° F. I found insufficient to drive off so much ether as to leave the resin firm when cold ; even at the temperature of 270°, maintained by means of a muriate of lime-bath for six hours, so large a quantity was retained, that the detached principles almost always weighed conjunctly three per cent. more than the crude subject of analysis ; nay, a heat of 400° subsequently applied for four hours by an oil-bath, which I considered the highest temperature to be safely applied to the resin, and which sent off copious bubbles of ethereal vapour, still left a slight surplus of weight in the separated principles when summed up.

The ether leaves, in the case of Pipe gamboge, a flocculent matter, which, when thoroughly exhausted by the repeated action of the same fluid, coheres somewhat and acquires a very pale yellowish white colour. In fine specimens of this Gamboge I have always found the flocculent residuum to be composed entirely of gum, presenting the leading characters of the prototype of the gummy principle named Arabin, from its forming almost the entire mass of gum arabic. It is entirely and easily soluble in cold water, forming a pale yellowish solution, which, when concentrated, becomes viscous, and when dried forms a transparent, reddish substance, of a mucilaginous taste without acridity. Braconnot thought the gum analogous to that of the plum-tree ; which, however, contains a considerable proportion of the insoluble variety of gum named Cerasin, a variety entirely absent in Pipe gamboge.

The proportions of the two principles vary somewhat, as will appear from the following results of trials made with one hundred grains of two distinct specimens apparently of the same quality.

	First.	Second.
Resin heated at 400°, till it ceased to lose weight	74.2	71.6
Arabin, or soluble gum, heated at 212°, till it ceased to lose weight	21.8	24.0
Moisture discharged by a heat of 270°	4.8	4.8
Woody fibre	trace.	trace.
Total....	100.8	100.4

In another analysis so much as 27.3 per cent. of gum was obtained. But as the resin was not carefully determined, and there was therefore no check on the analysis, the accuracy of that result cannot be positively relied on.

It follows that Pipe gamboge consists of resin and gum, without any volatile oil, which is a very common ingredient of other gummy resinous exudations. The large proportion of gum accounts well for its easy miscibility with water, by which, on the one hand, its suitableness for the purposes of the painter is judged of, and which, on the other hand, renders it in medical practice convertible into a smooth and perfect emulsion, without any of the additions usually resorted to for that end."

" 2.—Passing next to the lump or cake gamboge, it must appear evident, that the composition of this variety will vary much according to its quality.* * *" The chemical composition of Cake gamboge is also materially different. It is not, like the Pipe variety, entirely dissolved by the successive action of the two solvents, sulphuric ether and cold water. About eleven per cent of insoluble matter remains, which in cold water subsides commonly in two layers, the uppermost white, and very finely pulverulent, the lower one greyish, and rather flocculent. The former proved to be fecula, entirely soluble in boiling water, and then giving an abundant blue precipitate with tincture of iodine—the latter quite insoluble in boiling water, with even six hours of ebullition, burning entirely away, with the

* Its colour is so intense that it communicates an appreciable yellowness to ten thousand times its weight of spirit.

flame and odour of burning wood, and with a mere trace of earthy residue, and therefore apparently woody fibre, or lignin. The analysis of two samples gave results nearly concordant, as follows. One hundred grains were used, and all visible fragments of wood were excluded.

	First.	Second.
Resin, dried in oil-bath at 400°	64.3	65.0
Arabin, dried at 260°	20.7	19.7
Fecula, dried at 212°	6.2	5.0
Lignin, dried at 212°	4.4	6.2
Moisture	4.0	4.2
Total	99.6	100.1

The proportion between the gum and the resin is here identically the average proportion already mentioned as existing in Pipe gamboge; so that, on simply abstracting the fecula and woody fibre, an article is constituted of precisely the same chemical composition. This circumstance, coupled with the presence of the particular principle fecula, and the vesicular structure of the cakes, renders it extremely probable, if not certain, that cake gamboge is not simply a natural production, but rather a manufactured substance—an adulteration For in the first place, it is the pure exudation plus so much impurity; secondly, fecula is not known to be produced from the trunks, branches, or leaves of plants belonging to that part of the botanical system in which the true Gamboge tree undoubtedly will be found to be properly placed, and it is therefore almost impossible that its presence depends on some mere variety in the period of collection or other circumstance in vegetation; and thirdly, the vesicular texture, so different from the compact, uniform texture of Pipe gamboge, is exactly what might be expected from the process of wetting the exuded juice, beating it up with other pulverulent substances, and then drying it. It might be objected that eleven per cent. of foreign matter is a small addition for an adulteration. But this amount may, after all, be quite equivalent to the grower's profit from the pure article; and it will presently be seen, that a larger proportion of adulteration may so dilute the yellow tint of the mixture as to render it almost unmarketable."

CHEMICAL COMPOSITION OF COARSE GAMBOGE.

	First.	Second.
" Resin, dried in the oil-bath at 380°	61.4	35.0
Arabin, dried at 212°	17.2	14.2
Fecula, dried at 212°	7.8	19.0
Lignin, dried at 212°	7.8	22.0
Moisture disengaged at 350°	7.2	10.6
Total	101.4	100.8"

CHEMICAL COMPOSITION OF CEYLON GAMBOGE.

" The following results were obtained from three analysis of Mrs. Colonel Walker's specimens, evidently different in purity. The quantity used was one hundred grains.

	First.	Second.	Third.
Resin, heated at 400°	68.8	71.5	72.9
Arabin, dried at 240°	20.7	18.8	19.4
Fibre of wood and bark, at 212°	6.8	5.7	4.3
Moisture	4.6	not ascertained.	
Total	100.9	96.0	96.6
		Moisture not reckoned.	

Here it is evident that the proportion of gum and resin to one another is as nearly as possible the same, with their proportion in some specimens of fine Pipe gamboge."

" *November 28th.*—To the observations made above, on the external characters and composition of the different kinds of Gamboge, it may be well here to annex a brief notice of the *gambogioid* juices obtained from two trees, which have been at different times supposed by some to yield the genuine drug, namely, the *Garcinia cambogia,* and *Xanthochymus pictorius,*

I am here again indebted to Mrs. Colonel Walker for my subjects of analysis, having very lately received splendid specimens of the barks of both trees, with their exudations concreted on them.

The exudation of *Garcinia cambogia*, as I am informed by Mrs. Walker, concretes slowly and imperfectly, so as to remain long viscid in the climate of Ceylon. The specimens sent to me, on arriving here, still continued soft enough to receive the impression of the fingers when squeezed between them. The exudation was chiefly in the form of long slender tears, of a clear lemon-yellow tint, without odour or taste, of a distinct resinous appearance, both externally and in their fracture, and wholly incapable of forming an emulsion when rubbed with the wet finger. These properties are alone sufficient to establish it as a substance altogether distinct from true Gamboge; and this distinction is still further shown by its chemical composition.

Suspecting that its softness was owing to the presence of volatile oil, I distilled 50 grains of it with water in an apparatus, in which it was easy to measure any fluid given off, to the fourth part of a grain; and after repeated cohobation, there were obtained six grains of a lively yellow volatile oil, possessing a faint turpentine odour. From another portion, weighing 20 grains, the resin and volatile oil were removed conjunctly by sulphuric ether; and then cold water took up a principle agreeing entirely with Arabin in its characters; after which there was only left a little dark, brittle, fibrous matter, evidently from particles of the bark. The analysis gave the following results:

	Per cent.
Resin	66.0
Arabin	14.0
Volatile oil	12.0
Fibre of the bark	5.0
Loss	3.0
	100.0

It is not a little remarkable that this exudation, evidently a true gum-resin, and containing, too, a considerable proportion of gum, is nevertheless not emulsive. The resin differs essentially from that of true Gamboge, being somewhat less soluble in ether or rectified spirit, and possessing a colour somewhat different both in tint and in intensity. Its colour is not orange, but rather lemon-yellow; and its solution is so much less intense in tint than that of the resin of Siam or true Ceylon Gamboge, that the last two present an equal depth of shade when dissolved in ten times as much spirit as the other."

" Mr. Royle having expressed an opinion in his Illustrations of the Botany of the Himalayah mountains, that a kind of Gamboge may also be produced by another species of the natural family *Guttiferæ*, namely, the *Xanthochymus pictorius*,* it seemed to me desirable to determine that point also by an analysis of its resinous exudation, which Mrs. Walker's specimens, have put it in my power to accomplish.

The exudation on the bark of this species is even more different in appearance from true Gamboge, than that of the *Garcinia cambogia*. It forms small tears of a pale greyish-green colour, sometimes also pale yellowish-green; and it is translucent like a resin. It does not form an emulsion at all when rubbed with the wet finger. It is pretty hard, and in cold weather pulverizable.

From the facility with which it softens when heated, it probably contains some volatile oil; but my specimen could not afford me enough for ascertaining that point with care. For the same reason I could not attempt an exact quantitative analysis of its other component parts. But it is evidently a true gum resin, containing, however, less gum than that of the *Hebradendron*. Sulphuric ether removes a pale greenish-yellow resin, leaving an opaque glutinous mass, which is broken up and partially dissolved by cold water. The watery solution froths on agitation, and when evaporated leaves a viscous matter, evidently Arabin, or soluble gum. A small quantity of fibrous impurities and fleecy particles remains unattacked by the ether and cold water. One grain and seven-tenths of the gum resin yielded 1.3 of resin, 0.3 of gum, and 0.2 of fibre, that is, 76.5, 17.6, and 5.9 per cent. This result seems to indicate the absence of

* Illustrations, &c. p. 132, part iv.—1834.

volatile oil; but it cannot be relied on absolutely, on account of the small scale of the analysis. The result, however, is sufficiently accurate to show, when taken along with the sensible qualities of the gum resin, that the *Xanthochymus pictorius* does not yield an exudation resembling in any material property the true Gamboge of the *Hebradendron.*"

Remarks on Genera and Species. Dr. Lindley remarks "that European Botanists are much in want of good observations upon the living plants of *Guttiferæ*, and that there is no order that is more in need of elucidation from some skilful Indian Botanist than this." That such is a desideratum in Botany there can be no question, but I would, with much deference, suggest that European Botanists, who enjoy infinitely greater advantages for entering on the task of elucidation than Indian ones, should show the way, by thoroughly investigating the characters of the genera and species, so far as that can be done from preserved specimens. It may appear paradoxical to state that European Botanists enjoy greater advantages for this work than Indian ones, but it is nevertheless true. Indian Botanists are few, and very remote from each other, with but little intercourse, and generally having other duties to engage their attention, whence Botany, in place of a professional pursuit becomes with them a mere recreation. So situated, few enjoy the opportunities required for the successful elucidation of a difficult natural order, even when well qualified for the work; each, only becoming acquainted with the species, within his own limited circle, generally too few to admit of his attempting from them any thing like a comprehensive examination of a complex order. He therefore, in place of attempting the nearly hopeless task here assigned to him, more frequently when possessed of a scientific friend in Europe, sends specimens there to have them examined and named, and but too frequently is disappointed in his expectations. In this way large collections of all kinds of plants, from all parts of India, have gradually found their way to Europe and been brought together in the large European collections. Let these in the first instance be well investigated by a scientific Botanist, the genera and species clearly defined, their present confused synonymy unravelled, and such descriptions as can be made from dried specimens drawn up and published, to put the less qualified Indian Botanist in possession of the information thence attainable, and then he will have a firm foundation on which to build his observations made on growing plants. It is true that equally perfect descriptions cannot be made from dried specimens, as from growing plants, but I feel assured, from my own experience, that even with this most disheartening order, much more might have been done than has been yet effected. Having thus pointed out the disadvantages under which, in this country, we labour from want of materials to work upon, I trust due allowance will be made for such errors and defects as may appear in the following attempt at elucidation, taken nearly entirely from the examination of dried specimens, some of which doubtless would have been avoided had my series of specimens been more complete.

I believe I may with perfect safety set out with the proposition, that the order itself as it now stands is very badly constructed, being composed of the most heterogeneous materials. One section *Clusieæ*, has an ovary with many cells, with many ovules in each, a dehiscent capsular many valved fruit, and (except when the symmetry is disturbed by abortions) a quinary proportion of the parts of the flower—almost the very characters of *Hypericineæ*, and consequently, much more nearly allied to *Hypericineæ* than to *Garcinieæ:* whence it is no wonder, Botanists who form such groups, should find it difficult to draw the line of distinction between them and their nearest allies. The *Clusieæ* appear in short to be rather a section of *Hypericineæ* than of *Guttiferæ*, and their removal would certainly render the latter group more natural.

The next tribe *Garcinieæ*, the true *Guttiferæ*, has binary or quaternary flowers, many celled ovaries with solitary or very rarely several ovules, and an orange-like indehiscent fruit. This tribe therefore is more nearly allied to the *Aurantiaceæ*, but is readily distinguished by their quaternary not quinary proportion. Professor Martius proposes uniting these two sections to form the order *Garcineæ*, excluding the next tribe *Calophylleae*. The separation of the section *Calophylleae* is certainly an improvement, but still leaves the anomalous combination of two sets of plants differing so essentially in the same order; the one, having a quinary proportion of parts and capsular dehiscent fruit, while the other has a quaternary proportion of parts and an indehiscent fleshy one, merely on account of some similarity of habit.

The third tribe combined to form this order is the *Calophylleae*, trees associating in habit and in the binary arrangement of their floral envelopes, but having a drupacious 1-2 celled ovary, with one or several ovules, and a 1 or several seeded fruit, and differing so much in other respects

as to form but an indifferent union, which, as already observed, Professor Martius proposes to amend by the elevation of this section to a distinct order.

The fourth and last section, *Symphonieae,* of Choisy and DeCandolle's arrangement is also objectionable for the same reasons as the preceding, viz., its quinary proportion, besides which *Canella,* one of the genera referred to it, has alternate leaves. The stamens in this tribe are united into a tube as in *Meliaceae,* but differ from that order in the extrorse dehiscence of the anthers, and in so far might perhaps be advantageously separated from both to form a new order, the more so, as their properties are totally different from either; those of *Canella alba* one of the tribe, being intensely aromatic. Species presenting differences so marked no Botanist would ever think of combining in the same genus, and I cannot understand on what principle genera, in which they occur, should be admitted into the same natural order, since, such combinations can only tend to prove the futility of the name by setting natural affinities at defiance.

On the principle of preserving simplicity of character, and at the same time conformity to that character among the genera referred to the order, I propose, though closely allied in habit, to separate the genus *Stalagmitis* or *Xanthochymus* from *Guttiferæ.* A binary arrangement of the parts of the flower, (2 and its multiples) forms the essential characteristic of the order, 2-4-6 sepals and petals, 2-4-6-8 carpels or cells of the ovary, &c. but in *Xanthochymus* a quinary one prevails, 5 sepals and petals, 5 fascicules of stamens a 5, or by abortion 3, celled ovary, form the characteristics of that genus.

The want of uniformity between the characters of the genus and of the order is here most striking, and is such as to render it next to impossible for any one unacquainted with the genus to refer it, by its characters, to the order in which it is placed. To such anomalies much of the difficulty attending the study of the natural system of Botany is owing. Giving due weight therefore to characters derived from the number and arrangement of parts, it follows, that this genus must be removed from the order, and referred to some one in which a quinary arrangement prevails, such as *Hypericineæ,* or be made the type of a separate order. To me the former course seems the preferable one, since the only point of difference between the characters of the genus and the order, consists in the solitary ovules of the first, which in the last are usually, though not always, numerous, and in the structure of the embryo which partakes more of the character of *Guttiferæ* than *Hypericineæ.* In both a quinary order of parts exist, in both the filaments are united, forming androphores, and in both,we find a 5-celled ovary, with occasionally definite ovules. In a word the genus is much more closely allied to *Vismiæ* in its characters, than to any tribe of *Guttiferae,* and to that section of *Hypericineae* I think it ought to be removed.

On the principle here insisted upon, that no genus be admitted into the order in which a binary order of parts is not found to exist throughout the whole floral organization, it follows, that the order as constituted by both Cambessides and Meisner, its most recent expositors, must be entirely broken down, and the portion left to bear its name, reduced within very narrow limits. As I have not Cambessides' memoir to refer to, I follow Meisner's exposition of his (Cambessides) distribution of the order. Here Choisy's tribes are retained, but some of the genera transposed—*Mesua* for example, one of Choisy's *Calophylleae,* is removed to *Clusieae,* and though strictly binary in its structure, is placed between two genera, in which the quinary proportion prevails. *Gynotroches,* a genus of Blume, allied in many respects to *Garcinia,* and certainly I think referable to the same section in a natural distribution of the order, is placed somewhat artificially, in *Symphonieae,* and in direct opposition to the original character of that tribe which is to have the stamens united into a tube. To *Garcinieae* the genus *Stalagmitis,* including Roxburgh's *Xanthochymus,* and the larger half of Choisy and DeCandolle's genus *Garcinia,* (a most incongruous assemblage) is referred, in place of to *Calophylleae,* in which it and *Xanthochymus* had been placed by Choisy. *Calophylleae* thus shorn of three of the four genera originally referred to it still remains, and to supply the place of those removed, two others, which have, since the publication of Choisy's memoir been added to the order, viz., *Kayea,* Wall. and *Apoterium,* Blume, are given.

In these remarks I have confined myself to the Indian genera of the order, with which only I am well acquainted, but, judging from the characters of some of the American ones placed here, I cannot but think that most of them ought to be excluded, and the order limited in a great measure to Asiatic species, and I feel but little doubt, when it has been subjected to a thorough revision, that such will be the result. Hitherto, it seems to

have been considered a convenient receptacle for all manner of refractory plants, having opposite entire polished leaves, and square branches, however much they may depart from the characters of the order in the form and structure of the organs of re-production.

According to the arrangement I have proposed the Asiatic portion of the order, all that I undertake to investigate, might be thus distributed.

GUTTIFERÆ. Floral envelopes ranged in a binary order, (two and its multiples).

Suborder 1st.—*Garcinieae*—Ovary 4-6-8 or more celled : cells, usually, with one, rarely several, ovules attached to the inner angle of the cell next the axis of the fruit. Style short or wanting. Stigma spreading, lobed ; lobes corresponding in number with the cells of the ovary. Flowers axillary, solitary, or fascicled, peduncles 1-flowered, very rarely more. *Garcinia, Gynotroches.*

Suborder 2d.—*Calophylleae*—Ovary 1-2 celled : ovules solitary, or several, attached to the base, ascending. Style elongated. Stigma radiato-peltate. Peduncles axillary, 1-flowered, or racemose, or forming terminal panicles.

This suborder may again be divided into two sections, or might perhaps be advantageously removed altogether to form a distinct order, on account of the difference observed in the ovary and fruit, but for the present I, in accordance with all former practice, Professor Martius excepted, allow it to remain as a section of the order.

1st.—*Mesueae*—Ovary 2-celled : ovules several in each cell. Peduncles axillary, 1-flowered—*Mesua.*

2d.—*Calophylleae*—Ovary 1-celled : ovules solitary or several, erect. Flowers racemose, or panicled—*Calophyllum, Apoterium, Kayea.*

The genus *Xanthochymus* I exclude from the order on account of the quinary arrangement of its flowers, and for the present refer it to *Hypericineae*, as being the order most nearly akin, in which that structure prevails. It may be objected to this proposal, that many of the *Hypericineae* have quaternary flowers, but then, the ternary or quinary fascicles of stamens, and the 3 or 5-celled ovaries show, that that is not their normal structure, but the effect of abortion of parts. Taking number therefore as the basis of our classification, we can no longer experience the difficulty which has hitherto been felt in distinguishing the species referable to one or other of these orders, and however closely allied in all other respects, this character alone, preserves a clear and well marked line of demarcation between them.

If the precedent established by Dr. Graham in the formation of his genus *Hebradendron* be followed, we may, I fear, soon expect to see the off-sets from *Garcinia* about as numerous as its species now are, since that genus is separated on account of a variation in a single point of structure, and without reference to analogous forms met with in other species. The only point in which it differs from *Garcinia*, as defined in our Prodromus is—in having 1-celled circumcissile anthers—while the more usual form in that genus is to have them two celled, with introse longitudinal dehiscence. Should this be considered a satisfactory reason for its removal, then *G. Kydiana* Roxb. which has a four-sided connectivum with a polliniferous cell in each face, must equally be separated from the genus, as well as another species of which I possess specimens from Mergui, the anthers of which are 1-celled, dehising transversely across the apex. Another variation of structure which has been long observed in a few species of the genus will equally demand separation, as being of at least equal generic value, I allude to those in which the stamens of the male flower are united into four thick fleshy androphores, with a highly developed sterile pistil in the centre. Here then, assuming that we are justified in assigning generic value to such variations of structure, limited as they are to the male organization, are four distinct genera, and all, so far as such artificial characters can make them, equally stable. I confess that I have an objection to this kind of excessive sub-division, in as much as, whatever rule holds good with respect to genera must equally apply to orders, and must inevitably lead to the elevation of half our present species to the rank of genera, and an equal proportion of genera to natural orders ; both of which might be avoided by a slight extension of our characters, and still better by a careful and comprehensive investigation of groups of allied species and genera, before attempting their disunion in the formation of new genera and orders. In support of these views I think I may safely cite the recorded opinion of

the first living authority Mr. Robert Brown. He says in a letter to Dr. Graham referring to the plant which has called forth these remarks, "In your plant the structure of the anther is indeed very remarkable and might well induce you to consider it a new genus; but it is right to add, that approaches to this structure, and which serve to explain its analogy with the ordinary structure of the family exist in *Garcinia*, with which I suppose your plant would agree in its female flower as well as in fruit." From this concluding caution I imagine that, before establishing a genus on such grounds, he (Brown) would have ascertained the structure of the anther in the whole order, marked its variations, and then, and not till then, have determined on the propriety or otherwise of assigning a generic value to its variations: and I can scarcely avoid thinking, that had such a course been followed in that instance a sectional value only would have been awarded. I confess that a less perfect examination of the order, than that which improved materials has now enabled me to effect, led me into a similar error, on which occasion, I proposed to subdivide the genus *Garcinia* into three distinct genera: *Mangostana*, *Cambogia*, and *Stalagmitis* (see *Madras Journal of Science*, vol. 4, page 304). This suggestion has not so far as I am aware been yet adopted by any one, and I trust it will not, as I now consider it wrong in principle, the variations in structure, there pointed out, not meriting a higher than sectional value in a genus so strictly natural. Influenced by this reduced estimate of the relative value of the several structural variations mentioned above, it is my intention on the present occasion to keep the old genus together, but divided into sections in accordance with them. I am induced to do so from observing that the variations are limited to the male flowers, and do not on any occasion extend to the female. For example *G. Mangostana* and *G. cornea*, are referred to the same section, the former has 4-8 celled ovaries, and the latter usually 4, in *G. Kydiana*, Roxburgh describes the berry as being from 4 to 8 seeded, *G. cowa* from 6 to 8, and most of the others are described as having as far as 4, or 8 seeds, showing a general want of uniformity in this respect, variations, therefore, of the number of the cells of the ovary, cannot be admitted as generic, or even specific value in this genus. Should further acquaintance with the tribe show that in uniting *Hebradendron* or rather *Cambogia*, Lin. (for they are the same genus and the latter the more appropriate name) to *Garcinia*, I have erred, the error can be easily corrected, and in the mean time, my sections will afford the means of more easily determining the known species, and of referring to convenient places such new ones as may be discovered. For the present, nothing is more difficult than to make out from description the species of *Garcinia*. This is mainly owing to the male flowers, which afford by far the best specific characters, being too little attended to in characterizing them. Generally speaking, they are dioicous, and in collecting specimens care should be taken, to procure them of both sexes. The foliage, except in a very few instances, do not afford good discriminating characters, and when it does, is usually accompanied by others which are more to be relied upon.

The following is the arrangement which I propose for the distribution of the species of *Garcinia*.

Subgenus 1. *Mangostana*. Male: Stamens 4-adelphous, androphores, thick and fleshy, covered on all sides with anthers. Ovary rudimentary, supporting a large capitate, glabrous, abortive, stigma. Female—Stamens few, irregularly fascicled, usually imperfect. Ovary 4-8, or 10-celled.

§ I. *Anthers oblong, 2-celled, dehiscence, longitudinal introrse.*

§ II. *Anthers flattened above, 1-celled, dehiscing by a transverse slit.*

Subgenus 2. *Oxycarpus*.* Male: Stamens monadelphous, androphores short, thick, fleshy, placed in the centre of the flower, usually 4-sided, anthers numerous, sessile or sub-sessile, capitate, with or without a sterile pistil—Female: Stamens 12-20, frequently imperfect, fascicled or monadelphous, forming a ring round the base of the ovary—ovary superior, 4-8 or 10-celled.

§ I. *Anthers 4-sided, with a polliniferous cell on each side.*

* *Cambogia* would have been the more appropriate name for this subgenus, but the original *Cambogia gutta* having recently been re-elevated to the rank of a genus under a new designation I have thought it better not to employ that name lest, abler Botanists differing in opinion from me, should think that species generically distinct from *Garcinia*, in which case, Linnæus's name ought to be restored.

§ II. *Anthers 2-celled, oblong, dehiscing longitudinally, introrse.*

§ III. *Anthers sessile, depressed, flattened above, 1-celled, dehiscing circularly, (circumscissile).* Cambogia.—*Lin.*

In the following synopsis of the genus I shall distribute all the known species according to the above arrangement, premising however, that I have seldom encountered one, whose species are more difficult to unravel, and that I entertain but faint hopes of succeeding in my endeavour to render clear, that which seems to have been very obscure to most of my predecessors. Of these, Roxburgh is the one on whom I have reposed most confidence, his descriptions, with a few exceptions extending to every part of the plant, and being generally made from recent specimens, are the most correct and perfect.

A similar plan has been pursued with respect to the other genera of the order *Mesua, Gynotroches, Calophyllum, Kayea,* and *Calysaccion*, (*Apoterium* I consider a section, only, of *Calophyllum*) and thus will be placed before the Indian Botanist the most complete account of the Asiatic division of this difficult and hitherto ill understood order any where published. That both errors and omissions will be found, is most probable, since such seem almost unavoidable even under circumstances most favourable to the attainment of accuracy, and such I cannot flatter myself are those under which I write, limited as I am in the time requisite for the elaboration of such a monograph, and equally so in the space I feel myself at liberty to appropriate to it in this work. The whole order however required elucidation, and the means of doing so to a considerable extent having been placed at my disposal, I feel, that I should not have done justice to those who kindly contributed the materials, did I not do my utmost to render them available to the objects of science by their publication.

SYNOPSIS OF THE INDIAN GUTTIFERÆ.

Sub-Order—*Garciniece.*

Garcinia—Lin. Willd. &c.

Cambogia, Lin.—*Mangostana*, Gært.—*Brindonia*, Pet. Thour ?—*Oxycarpus*, Lour.—*Stalagmitis*, Murray, partly ? Cambess. partly.—*Hebradendron*, Graham.

Flowers polygamous, diœeious. Sepals 4, persistent. Petals 4, deeiduous. Male—Stamens numerous, 4 adelphous, or monadelphous, with or without an imperfect pistillum. Anthers 1-2-4 celled, dehiscence various. Female—Stamens few or numerous, usually, 4 adelphous, the faseicles opposite the sepals—anthers generally imperfeet. Ovary 4-10, eelled: Ovules solitary in each cell. Style very short or wanting. Stigma peltate, lobed; lobes corresponding in number with the cells. Fruit fleshy, indehiscent, 4-10 celled, crowned with the permanent stigma, globose, or slightly elongated, sometimes furrowed. Seeds, solitary in eaeh cell—Trees, with opposite, coriaceous, shining, glabrous leaves; the extreme branches usually somewhat 4-sided.

Subgenus Mangostana—Gært. Male—Stamens very numerous, tetradelphous; androphores, thick and fleshy, covered on all sides with anthers—Ovary rudimentary, supporting a large globose sterile stigma.

§ I. *Anthers oblong, 2-celled, dehiscing longitudinally.*

1. *G. Mangostana,* (Lin.) Leaves somewhat rhomboidal, obtuse; male—flowers fascicled; female—solitary, terminal: fruit globose, 6-10 eelled, (about the size of an orange).

2. *G. cornea,* (Lin.) Leaves oval, oblong, acute at both ends; flowers terminal, male aggregated; female solitary: fruit globose, 4-eelled, (about the size of a lime).

3. *G. speciosa*—(Wall. Pl. As. Rar. 3, page 37-258.) Leaves elliptic, oblong, aeute, male flowers aggregated in the terminal axils, stamens 4 adelphous, androphores, closely eovered with anthers, sterile stigma flat, 4-angled: female ?

The male plant only of this species is known, the flowers seem larger than those of any of the other species of the genus.

4. *G. Celebica* (Choisy). Leaves ovate, lanceolate, acute: flowers axillary, solitary, near the ends of the branches: male—stamens 4 adelphous, androphores, thickly covered with anthers: female—stigma entire, concave, furrowed within, fruit globose.

The deseription of Rumph, Herb. Amb. 1, page 134, of the stamens of the male flower, is so precise as not to leave a doubt that this species, belongs to this seetion.

§ II. *Anthers 1-celled, depressed—flattened above, dehiscing transversely.*

5. *G. Merguensis*—R. W. Male—flowers axillary, faseicled: exterior pair of sepals minute, the interior ones large in proportion—female.

Mergui.—Communicated by Wm. Griffith, Esq. (No. 97, in Herb. Griff.)

Arborious, or shrubby, very ramous, leaves lanceolate, acuminated at the point: flowers numerous, small, fascicled in the axis of the leaves, fascicles 3-5 flowered, sepals 4, the exterior pair minute, bracteæ-form, the interior pair large, and before anthesis completely enclosing the rest of the flower. Stamens very numerous, filaments united into four thick fleshy androphores, eompletely covered with sessile, flattened, 1-celled anthers, dehiscing transversely across the apex. Abortive, pistil globose, capitate, glabrous, longer than the stamens. The female I have not seen.

Subgenus Oxycarpus—Lour. Male—Stamens numerous, monadelphous, filaments united into a short, fleshy, 4-sided, sub-capitate androphore, eovered with anthers: with or without a minute, rudimentary pistil.

§ I. *Connectivum of the anthers 4-sided, with a polliniferous cell in each side, four angled at the apex.*

Observation.—The extension of these cells, causing the absorption of two of the partitions, would produce the form which distinguishes the next section, the more usual form of the genus. and if all the four partitions were absorbed, the 1-celled anthers which constitutes the distinctive peculiarity of the 3 section would result: hence 4 cells may perhaps be considered the normal structure, and the other forms transitions caused by an excessive development of pollen from the operation of some yet unknown cause.

6. *G. Kydiana* (Roxb.) Hort. Bengalensis. *G. Kydia* Roxb. Fl. Ind. not W. and A. Prod.

This is I suspect the species to which Mr. Brown alludes in his letter to Dr. Graham, where he says, " but it is right to add, that approaches to this structure, and which serve to explain its analogy with the ordinary structure of the family, exist in *Garcinia.*"

§ II. *Anthers oblong, 2-celled, dehiscing longitudinally, introrse.*

A. *Fruit globose, not furrowed.*

7. *G. pedunculata,* (Roxb.) Flowers terminal, long peduncled: male—fascicled; female—solitary, or two or three from the same branch: fruit very large: (2 pounds weight) leaves obovate, cuniate, membranacious, marked with numerous prominent parallel veins.

A stately tree about 60 feet high. The leaves of this species differ from those of all the others of the genus.

8. *G. paniculata,* (Roxb.) Male—flowers panicled; panicles axillary, many flowered; female—racemose, subsessile; racemes terminal: fruit globose, small, 4-seeded.

The fruit of this species, raised in Calcutta, is represented as about the size of a cherry, that of native specimens received from Silhet about twice as large. The former greatly resembles that of *G. morella,* Gærtner.

9. *G. purpuria,* (Roxb.) Leaves obovate, lanceolate, acuminated: male—flowers longish pedicelled, aggregated, 4-8 congested in the terminal axils, 2-4 in the lateral ones: column of stamens short, capitate, filaments free, for a short distance at the apex; anthers few, (12-20) occasionally one or two in the centre, simulating a rudimentary ovary: fruit globose, not furrowed, 4-8 seeded, whole fruit deep purple.

Roxburgh received specimens of this plant from Malabar, under the name of *Mahi Mangostan.* The specimens from which this character is taken, were communicated by Dr. Wallich, from the Calcutta Botanic garden, and of course identical with Roxburgh's. Rumph. Amb.—3 to 32, may be cited as a figure of this plant, though a different species, except that his is the female, mine the male plant, but having full grown, detached, fruit, which seems to correspond in size and form with the Amboyna one.

10. *G. lanceæfolia,* (Roxb.) Leaves narrow lanceolate, acuminate: Male—flowers axillary, and terminal, solitary, short pedicelled; stamens all united, anthers capitate; in the female about 20, filaments dilated at the base, and united, forming a ring round the base of the ovary, splitting irregularly into several fascicles, stigma 6-8 lobed, fruit somewhat obovate, 6-8 celled.

G. dioica. ? Blume, Bijd. 1, page 215.

Native of Silhet.

Roxburgh has figured the female plant only, I am indebted to Dr. Wallich for the specimens which have enabled me to characterize the male one—It is closely allied to the former but quite distinct.

11. ? *G. Cochin-chinensis* (Choisy). Leaves ovate, oblong, acute, flowers lateral, congested, white; short peduncled: berry, reddish yellow, pear-shaped.

Hab.—China and India.

Rumphius, Herb. Amb. 3-32, is the authority for this species—it seems referable to this section, but is too imperfectly known to be referred to, with certainty.

B. *Fruit globose or oval, furrowed.*

To this section a long list of names belong, but I suspect very few species: at least, if each name really belongs to a distinct species I must confess my inability to find marks among the characters assigned by which to distinguish them. The following is the list of names referable to this section.

G. Cambogia, (Desrous) *G. Cambogia,* (Roxb.) *G. Zeylanica,* (Roxb.) *G. Cowa,* (Roxb.) *G. Affinis,* (W. and A.) *G. Kydia,* (W. and A. not Roxb.) ? *G. Indica,* Choisy.

These may be thus grouped and briefly defined.

12. *G. Cambogia,* (Desrous, Moon's Catalogue of Ceylon plants, not Roxb.) Fruit somewhat elongated, tapering a little at the ends, furrows broad, with angular edges, and intervening flattened, or but slightly rounded ridges, fruit yellow.

G. Kydia, (W. and A.) ? *G. Indica,* Choisy, and D. C. Rheede, Hort. Mal. 1 tab. 24.

This species I have now found at Courtallum, in Malabar, and in Ceylon: different specimens vary somewhat in the appearance of their foliage, and in the number and position of their flowers, but all agree in having the ridges and furrows alike square, as if cut artificially.

This to my mind is unquestionably the plant figured by Rheede, and therefore the Garcinia Cambogia of Desrousseaux, and all subsequent authors who have followed him, but is not the Cambogia Gutta described by Linnæus, Fl. Zeyl. No. 195: neither is it Garcinia Cambogia Roxb. if his figure and description are correct, as both represent a plant having globose fruit, with narrow sloping furrows and intermediate semicircular ridges or costæ like those of a melon. For these reasons I consider Roxburgh's plant a species distinct from Rheede's, but not distinct (so far as I can judge from his figure and definition) from his own *G. cowa* and *G. Zeylanica,* in both of which, the fruit is described as sphærical and torose (swelling over the seeds) which is indeed the only mark on which it appears to me the slightest dependence can be placed. These species therefore I unite, assigning one specific name, for the whole.

13. *G. Roxburgii* (R. W.) Fruit globose, 6-8, furrowed; furrows narrow, sloping towards the bottom: intermediate costæ or ridges rounded: male—flowers aggregated or solitary, axillary, or terminal; female—flowers usually, solitary, nearly sessile, sometimes, when terminal, two or three together.

G. Cambogia, Roxb. cor. pl. 3-298—Fl. Ind. 2-621, not Desrous: *G. Zeylanica,* Roxb. Fl. Ind. 2-621, *G. Cowa,* Roxb. Fl. Ind. 2-622, W. and A. Prod. 1-101. *Garcinia affinis* (W. and A.)

The depth of the furrows varies, they are deeper in *G. Cambogia,* less so in *G. Zeylanica* and *Cowa,* but in all totally different from those of the preceding.

I have not quoted Linnæus' *Cambogia Gutta* for either of these, though it seems the general opinion of Botanists that it belongs to the former. This opinion however, his brief description of the plant before him in the flora Zeylanica, shows to be erroneous, and proves almost to demonstration that that it is Dr. Graham's Hebradendron. The following are his words " *Rami oppositi. Folia lanceolato-ovata, integerima, petiolata,*

opposita. Flores verticillati sessiles. It is in truth the only plant of the genus in Ceylon, having sessile verticelled flowers. In his generic character he describes the anthers, *antheræ subrotundæ*, the pistil *germen subrotandum striatum, stylus, nulus. Stigma quadrifidum persistens*, and finally, the pericarp. *Pomum subrotundum octies sulcatum octoloculare*—showing clearly that the character of the flower and ovary is taken from one species, and of the fruit from a different, owing to the imperfection of his specimens and his not being aware that the lobes of the stigma afford a sure indication of the number of cells of the fruit. His *Cambogia*, however, baring this error is certainly the Gamboge plant of Ceylon, which is further established, as Dr. Graham informs us, by the examination of the specimen in Herman's Herbarum, " which may be considered the type of Linnæus' *Cambogia gutta*"—If therefore that plant is to be elevated to the rank of a genus I should say his name ought unquestionably to be retained with an amended character, and Botany relieved from the unseemly allusion conveyed under the new one. If Murray's *Stalagmitis* is on account of priority to supplant Roxburgh's *Xanthochymus*, much more must Linnæus' *Cambogia* supplant Graham's *Hebradendron*, partly for the same reason, priority, but principally, because Dr. Graham knew when he gave the name, that his plant was identical with that of Linnæus, while it was almost impossible that Roxburgh could ever recognize his *Xanthochymus* in Murray's character of *Stalagmitis*, made up as it is, from two genera (*Garcinia* and *Xanthochymus*) so distinct as not to be referable even to the same natural order. In my opinion *Stalagmitis* ought to be suppressed, and *Xanthochymus* retained.

In my collection there are specimens of I think, though not without some doubt, a third species referable to this section, (fruit sulcated) the fruit is 4-celled, with four deep abrupt furrows, and of an oblong conical shape.

14. *G. conicarpa* (R.W.) Fruit conical, 4-seeded, 4-furrowed, furrows angular: leaves sub-spathulate, very obtuse, longish petioled: flowers sub-sessile in the terminal axils: (?) male—stamens few, 8-12, filaments united into a slender column, equalling the sepals.

Hab. Female—*Shevagherry hills in deep mountain valleys*—Male: *Ceylon.* I have introduced a mark of doubt before the character of the male, from feeling uncertain, on account of the very different stations, whether or not it appertains to the same species. In the form of the leaves and position of the flowers they agree.

§ III. *Anthers sessile, depressed-flattened above, 1-celled, dehiscing circularly, (circumscissile).* Cambogia--*Lin.*

15. *G. gutta* (R.W.) Flowers sessile, aggregated in the axils of the leaves, apparently verticelled round the articulations of the branches where the leaves have fallen, fruit globose, about the size of a cherry, 4-seeded, leaves from broad lanceolate, to rhomboidal, obtusely attenuated at both ends.

Ceylon frequent, not uncommon about Colombo, and generally on the south-west coast of the island.

Cambogia gutta Lin. *Hebradendron Cambogioides*, Graham, Hooker's Comp. Bot. Mag. with all his synonyms, including the above of Linnæus. Lind: Flor. Med. R. W. Ill: Ind. Bot. tab. 44.

16. *G. pictoria*, (Roxb.) Flowers axillary, solitary, anthers of the male flower " peltate" of the female " 2-lobed and seemingly fertile" fruit, very slightly furrowed between the seeds; seeds four.

Hab.—Malabar and Wynaad, jungles.

Though I consider this a distinct species I am unable from an examination of Roxburgh's drawing and description, to assign better characters. The difference of the anthers of the female flowers afford the best mark, which in the former are like the male " peltate," in this 2-lobed and 2-celled, (the ordinary structure) and of course reducing the value of that character as a generic distinction.

17. *G. elliptica ?* (Wall.) Leaves large, coriaceous, elliptic, obtuse, abruptly and shortly acuminated: female—flowers sessile, axillary, ovary 4-celled, anthers circumscissile.

Hab.—Mergui.

My specimens of this plant were communicated by Mr. Griffith, they are the female only and somewhat past flower. I was however enabled to refer it to this section, by the examination of some anthers which were still attached, and also by the habit, especially the sessile flowers. The leaves are longish petioled, and at least three times the size of those of the Ceylon plant, of an oval shape, and very little attenuated at either base or apex. I refer it doubtfully to Wallich's elliptica, on the authority of Dr. Graham, who states that it *G. elliptica* Wall. agrees in the character of the anthers with his Ceylon specimens.

Do the following belong to this section; and are they distinct species?

18. *G. lateriflora.* (Blume, Bijd. 1, page 215), Ramuli roundish, leaves elliptic oblong, obtusely acuminated, acute at the base, coriaceous: flowers congested, lateral, sessile—(Calyx 4 sepals, petals 4, stamens monadelphous, in a single series; ovary, 4-celled: stigma sessile, multifid: berry globose, 4-celled—a tree 40-50 feet high.)

Obs.—The female flowe. only of this seems to be known whence he infers the species is hermaphrodite, and on that account distinct from.

19. *G. javanica*, (Blume, l. c.) Ramuli roundish, leaves oval, acute at both ends, blunt pointed, coriaceous: flowers congested, sessile, aggregated, (allied to *G. dioica*)—a tree 30 feet high, flowers dioicous, yellowish, ovary slightly furrowed, 4-celled.

Obs.—The sessile aggregated flowers and 4-celled fruit of both these plants, leads me to suspect that they both belong to this section, and that they are but varieties of the same species.

Species imperfectly known.

20. *G. gutta*, Roxb. Hort. Beng. Wall. list N. 4866.
21. *G. boobicowa*, Roxb. l. c.
22. *G. bhumicowa*, Wall. l. 4858.
23. *G. fascicularis*, Wall. l. 4853.
24. *G. affinis*, Wall. l. 4854.
25. *G. heterandra*, Wall. l. 4856.
26. *G. corymbosa*, Wall. l. 4859.
27. *G. umbilifera*, Roxb. l. c. and Wall. l. 4864.
28. *G. lobulosa*, Wall. l. 4868.
29. *G. elliptica*, Wall. l. 4869.
30. *G. Choisyana*, Wall. l. 4870.
31. *G. acuminata*, Wall. l. 4871.
32. *G. euginifolia*, Wall. l. 4873.

Species excluded.

G. malabarica, (Desrous) Lam. dict. *Dyospyros* species ?

G. elliptica, (Choisy). Stamens pentadelphous—*Xanthochymus* species ?

? *G. longifolia*, (Blume). " Stigmate, sub. 5—radiato" *Xanthochymus* species ?

? GYNOTROCHES, Blume, Bijd, 1-218.

Calyx. 4-parted, persistent. Petals 4, fimbriated. Disk, hypogynous, bearing the stamens on its margin. Stamens 8. Ovary, 6-8 celled; cells, 3-ovuled. Style, filiform. Stigma, peltato—radiate. Berry globose, pulpy, 4-6 celled. Seeds compressed, solitary by abortion, fixed to the axis.

A large tree with opposite elliptic, oblong, coriaceous leaves, acute at both ends. Peduncles congested, axillary, 1-flowered.

1. *G. axillaris*, (Blume). Java on the heights of Salak, flowers October and May.

This genus seems to form the connecting link between *Guttiferæ* and *Hypericineæ*, having the quaternary flowers of the one and the polysporous cells of the ovarium of the other. It associates better with *Garcinieæ* than *Calophyllieæ*, on account of the ovules being attached to the axis, not the base of the cells as in that sub-order.

SUBORDER—CALOPHYLLIEÆ.

Section I.—Mesueæ.

Mesua.—Lin.

The species of this genus seem to be involved in considerable obscurity, apparently owing to no one having had an opportunity of comparing specimens from different countries. The original *M. ferrea* is from Ceylon, and is well described by Linnæus in his flora Zeylanica. He quotes Rheede Mal. 3 t. 53, as a synonym, and in that, it is my impression he is right, though the figure represents a specimen greatly exceeding, in the size of its leaves and flowers, those I have from Ceylon. This however, Choisy has separated from the Linnæan plant, and called it *M. speciosa*, a very appropriate name, which, until furnished with better materials I shall not attempt to disturb. He (Choisy) quotes as an authority for his *M. ferrea*, a figure of Rumphius 7 tab. 2. This figure I have not an opportunity of consulting as my copy is incomplete, in that part, but I have reason to believe the synonym erroneous, as I have specimens from Mergui, communicated by Mr. Griffith, which seem exactly to quadrate with his character, though quite distinct from the Ceylon plant. Roxburgh again describes under the same name a plant differing from both, and readily distinguished by having its flowers terminal, rarely axillary, " solitary or in pairs" a character which perfectly corresponds with specimens communicated to me by Dr. Wallich, under Roxburgh's name, *M. ferrea*. The *M. ferrea* again of our Prodromus appears different from all the others in the diminutive size of its leaves and flowers, and in wanting the thick coating of white bloom on the under surface of its leaves so conspicuous on the Ceylon plant. The *M. ferrea*, of Blume, I cannot with certainty refer to any of the above, unless perhaps to my Mergui plant, and that merely on account of the introduction of the words "*pedunculis axillaribus*" indicative of the presence of a conspicuous peduncle, which it has, while all the others have the flowers nearly sessile, or on very short peduncles. These various forms may be thus characterized and designated.

1. *M. speciosa*, (Choisy D. C. prod. 1, page 562). Leaves very long, linear, lanceolate, acute: flowers subsessile; petals roundish, regular: ripe fruit 4-seeded. Rheede, Hort. Mal. 3, t. 53, excluding all other synonyms.

Woods of Malabar.

2. *M. ferrea*, (Lin. sp. 734). Leaves lanceolate, acute at both ends, ending in a long tapering acumen, bright shining green above, beneath white, from a thickish coating of a pulverulent or scaly incrustation: flowers axillary, solitary, subsessile.

Ceylon, frequent.

A beautiful tree, with numerous large, yellow, fragrant flowers, decorating its slender pendulous ramuli: altogether, when in flower, one of the most ornamental trees I have ever seen.

3. *M. Roxburghii*, (R. W.) Leaves lanceolate, shortly acuminate, acute, coriaceous, bright shining green above, glaucous beneath, flowers terminal, solitary, or paired (one from the axil of each terminal leaf,) short pedicelled, petals subunguiculate, obcordate, curled on the margin, " capsule about the size of a crab apple, nearly round with an acute point, 1-celled, 1-4 seeded, the partition nearly obliterated, 2-valved."

M. ferrea, Roxb. Fl. Ind. 2, page 605.

Bengal about Calcutta.

This is perhaps too closely allied to the former, the principal difference being in the flower bearing ramuli, of this having but one or at most two flowers confined to the apex, while in the other they occupy the axils of many pairs of leaves all along the branch. It has besides the appearance of being a much more rigid plant than the Ceylon one. The terminal solitary flowers mentioned by Roxburgh 30 years ago, is still the same in my specimens gathered last year, and probably from very different plants from those which he described, a circumstance affording considerable collateral support to the opinion that they are distinct species.

4. *M. coromandelina*, (R.W.) Leaves narrow lanceolate, ending in a long tapering blunt pointed acumen, bright shining green above, paler beneath, but scarcely glaucous: flowers axillary and terminal; peduncles shorter than the petiols.

M. ferrea, W. and A. Prod.

Courtallum in woods.

A very handsome tree. The very diminutive size of the leaves and flowers of this, as compared, with those of all the preceding, not less than the disappearance of the white glaucous crust so conspicuous on all the others, lead me to consider it distinct. The leaves which in these are from 5 to 7 inches long and 1¼ to 1½ broad, do not in this exceed 2½ long by about ½ an inch in breadth, the flowers are small in proportion.

5. *M. pedunculata*, (R. W.) Leaves lanceolate, acute, somewhat abruptly acuminated, glaucous beneath: flowers axillary, large, frequently paired, peduncles about twice the length of the petiols.

M. ferrea, ? Choisy, D. C. Prod. Blume, Bijd.

Mergui.—Communicated by Wm. Griffith, Esq.

The long peduncled twin flowers of this species, readily distinguish it from all the preceding, and proclaim the tree a very beautiful one when in full flower.

Section II.—Calophylleæ.

Calophyllum—Lin.

The very peculiar venation of the leaves at once distinguishes this genus, almost without reference to the fructification, but the discrimination of the species is by no means so easy, indeed the circumstance that marks them out as members of the same family, a strong family likeness, equally serves to render difficult their distinction from each other. They do however afford some useful sectional marks in the number of parts composing the floral envelopes. In all, these parts, whether we choose to call them calyx or corolla, are petaloid; to avoid therefore the inconvenience that might arise from calling parts sepals, which if removed from the flower and laid side by side with others occupying the place of petals, could not by external characters, be distinguished, I shall group the whole under the intermediate term *perianth*, and subdivide the genus into sections, depending not on the number of sepals or petals, which in the estimation of some Botanists, seem, in this genus, to be convertible terms, but according to the number of leaves of the *perianth*, the first section having 12, the

second 8, and the third 4. This arrangement is nearly the same as Choisy's in DeCandolle's Prod. namely—sepals 4, or 2, or wanting, the last section very unphilosophical. The first step therefore in the process of reducing a species of *Calophyllum* is easy, not so the subsequent ones, especially where there is a considerable number of forms to be reduced, owing to the characters of the species being generally so loosely constructed that it seems next to impossible to say to what form they are limited; such, strange to say, are those even of Roxburgh, and not being as usual, aided by full descriptions, leaves the whole involved in doubt and uncertainty. Whether I shall be able to draw more precise characters is uncertain, but to prevent my meaning being mistaken I shall publish figures of all the species of which I have specimens, and trust Dr. Wallich will enable me to add, so far as they extend, the figures left by Dr. Roxburgh.

§ I. *Leaves of the Pereanth* 12—(*4 sepals and* 8 *petals.)*

1. *C. Walkerii*, (R. W.) A large tree, branches terete, leaves nearly round or obcordate, very thick and coriaceous: racemes axillary, congested on the ends of the branches, the extreme ones (from the abortion of the leaves) forming a terminal panicle, exterior pair of sepals much smaller than the interior, inner row of petals smaller than the outer, fruit sphærical, about the size of a pretty large cherry, pericarp very thick and coriaceous.

Newera Ellia Ceylon, at an elevation of 7000 *feet—also on Adam's peak, but there a smaller tree.*

This magnificent species, which I have dedicated to my friend Colonel Walker, from whom I first received specimens, is observed to flower only once in three years. The figure I may here remark, which was made from a dried specimen, does not give a very good idea of the magnificence of the inflorescence, owing to its being in rather too young a state.

2. *C. Blumii*, (R. W.) " Leaves obovate, elliptic, obtuse, or emarginate; ramuli terete: flowers laxly, racemose; racemes axillary, solitary; pedicels 1-flowered, sub-opposite. (Calyx 4 sepals, caducous: petals 8, unequal, white. Stamens numerous, 5-6 adelphous at the base; anthers oblong, opening by two pores, *(apice 2 perforatæ)*. Ovary 1-seeded: style filiform, inflexed: stigma capitate: nut 1-seeded.")—Blume.

Calophyllum inophyllum—Blume, Bijd. 1, page 217.

The above character is copied from Blume, I do not know the plant, but the 4 sepals and 8 petals prove that it cannot be C. *inophyllum.*

§ II. *Leaves of the Perianth* 8 (*sepals* 4, *petals* 4.)

3. C. *inophyllum*, (Lin.) Branches terete; leaves elliptical, passing into obovate, sometimes emarginate, racemes axillary, loose: exterior sepals smaller, interior about equal to the petals (pure white) all petaloid: stamens numerous, irregularly polyadelphous near the base: ovary globose, (reddish purple) elevated on a short gynophore: fruit sphærical, about the size of a large cherry.

C. *inophyllum*, Choisy and others, excluding Rumphius' synonym—*Ponna marum*, Rheede, Hort. Mal. 4, t. 38.

A very beautiful tree, with delightfully fragrant flowers, frequent in Malabar, more rare on the Coromandel coast.

The timber of this tree, though coarse grained, is considered very valuable for some purposes in ship-building, and the seeds afford a good lamp oil.

4. C. *Bintagor*, (Roxb. Fl. Ind. 2-607.) " Twigs cylindric, leaves oblong, emarginate, base tapering, lucid, finely veined" (Roxb.) fruit large, about the size of a small apple or billiard ball, sphærical, fleshy.

This species I only know from Roxburgh's imperfect character and Rumphius' figure, which Roxburgh says, " is a bad figure of this beautiful tree." Rumphius however is so great an admirer of the tree, that his description is quite poetical, but much too diffuse for quotation, his figure is usually quoted for C. *inophyllum.*

5. C. *tomentosum*, (R. W.) Young shoots square, and with the petiols and peduncles of the flowers, thickly clothed with ferruginous tomentum: leaves varying from oval to narrow lanceolate, attenuated at both ends, undulated on the margin, racemes axillary, loose, few flowered: fruit—.

Ceylon.—Colonel Walker.

Of this species there are two very distinct varieties, one with oval leaves ending in a short abrupt blunt acumen, and much undulated on the margin, the other with long, rather narrow lanceolate leaves, tapering to a fine point at each end, and very slightly undulated, but in both the tomentose, rusty coloured, square ramuli are conspicuous, in both the axils of the leaves are furnished with similarly clothed buds, and in both the branches are terminated by a larger oblong bud, like those of trees of temperate climates, indicating that this is a deciduous species from the higher parts of the island, a point however on which I am not informed.

6. C. *angustifolium*, (Roxb. Fl. Ind. 2-608.) " Twigs cylindrical. Leaves short petioled, lanceolate, with lengthened somewhat obtuse points, lucid, finely veined: flowers in axillary fascicles, pedicels with a cyathiform apex." Roxb.

A native of Prince of Wales' Island said to be a tree of great size, and to afford the masts and spars known under the name of *Peon.*

7. C. *spetabile*, (Willd. and Choisy, in D. C.'s Prod. 1-562.) " Leaves elliptic, lanceolate, or rarely ovate-elliptic, usually acute at both ends: ramuli terete: flowers laxly, racemose: racemes axillary, peduncles 1-flowered, usually opposite.

Rumph. Amb. 2-72, is quoted as a figure of this plant, but I suspect without consulting the description from which I feel disposed to refer the Amboyna plant to the next section. These three are possibly the same species, but the characters of neither of the two last, as here quoted, are reconcilable with mine, nor do they sufficiently quadrate with each other, to admit of my uniting them without reference to specimens.

8. C. *decipiens*, (R. W.) Young shoots square, leaves from oval to obovate, emarginate, or sometimes obcordate, firm and coriaceous, racemes axillary, or from the scares of fallen leaves, few flowered, pedicels, rather short (about half an inch): sepals 4: petals 4 caducous: stamens numerous: fruit small, oval, somewhat attenuated at both ends.

C. *calaba*, Lin. partly. Lind. Fl. Med.—C. *apetalum*, Willd.—C. *spurium*, Choisy, in D. C. Prod. 1-563, W. and A. Prod. 1-103.—Rheede, Hort. Mal. 4-39—not Burm. Thes. Zel.-60.

Willdenow's examination of this plant led him to the conclusion that it had no petals, hence he called it C. *apetalum*. Choisy on the other hand, but apparently without examining a flower for his own satisfaction, arrived by some means unknown to me (not having his memoir to consult) at the very unphilosophical conclusion that it had four petals and no calyx, and hence he called it C. *spurium*. Mr. Arnott and I afterwards re-

examined flowers, and concluded both were wrong, and that the flower had 2 sepals and 2 petals, and therefore adopted Choisy's name as the better of the two, though we thought both bad. I have now ascertained that Willdenow was the nearer right of the three, but that we are all wrong. The examination of flower-buds before anthesis invariably showed a *perianth* of eight parts, while flowers after anthesis as regularly showed one of four, and these the exterior calycine series, the interior or coroloide ones having disappeared—being then neither apetalous, nor spurious, from the absence of its calyx, I have judged it advisable to give a new name, and have selected one equally expressive of past and, possibly, present blunders, which will not, I conceive, require further alteration.

§ III. *Leaves of the Perianth* 4—*(sepals* 2, *petals* 2 ? *or sepals* 4, *petals* 0 ?*)* Apoterium, *Blume.*

9. C. *Moonii*, (R.W.) Ramuli terete, leaves long, linear lanceolate, (8-12 inches long, 1½ broad) acute, floral ones about oval: flowers short pedicelled, forming numerous small umbellate panicles: panicles axillary, solitary, congested towards the ends of the branches, forming together large leapy terminal panicles: floral envelopes 4, the interior pair the larger: fruit—.

C. *longifolium*, Moon's MSS. not Willdenow.

Ceylon.—Eastern Korle, Moon.

This plant seems only to have been found by Mr. Moon—and the specimen before me is not such as to admit of a very perfect character being made from it. The very long lanceolate leaves of the older branches (the larger ones at least a foot in length) and the smaller almost oval floral ones, mixed with the large terminal, very many flowered, panicles, seem to indicate, that the tree when in full flower, must be one of surpassing beauty.

10. C. *Burmanni*, (R.W.) Young shoots, quadrangular, tomentose, leaves oval or slightly obovate, spathulate, sometimes sub-emarginate, panicles small, axillary, few flowered, pedicels opposite, usually longer than the peduncles, furnished at the base with a small deciduous bractea: perianth four-leaved, fruit small, globose, or very slightly oval.

C. *calaba*, Lin. partly.—Burm. Thes. Zeyl. tab. 60.

Ceylon.

Burman's fignre I consider the typical form of this species and is a good representation of the plant so far as it goes, the fruit only being required to render it nearly perfect, but there is now before me another form which I am uncertain whether to consider a species or a variety. The forms of the leaves are nearly the same, but more decidedly oval and much smaller, the inflorescence also differs a little; in both it is imperfectly umbellate panicled, but in this the flowers are much more numerous and the peduncles and pedicels shorter, the structure, however, of the flower is the same: the fruit I have not seen, and while it remains unknown I prefer considering this form a variety rather than a species.

β parvifolium, young shoots quadrangular, tomentose: leaves from oval to obovate, spathulate, tapering towards the base: peduncles axillary, several flowered, rarely one flowered, pedicels opposite, short, furnished at the base, with a minute deciduous bractea: perianth four-leaved: fruit—.

I have a second variety from Mergui intermediate between the Ceylon ones. It has the larger leaves and small fruit of the first with the short umbellate panicles of the second; and has in addition the bracteæ, which in the Ceylon plants are very small, almost inconspicuous and early deciduous, as long as the pedicels and as permanent as the flowers.

γ bractiatum. Leaves oblong oval or obovate, very obtuse, often emarginate at the apex: panicles much shorter than the leaves, axillary, pedicels short, almost concealed by the lanceolate, acute, pubescent bractea: fruit globose.

Mergui.—Griffith Herb. Nos. 439 and 595—Flower and fruit. *Apoterium sulatri.* ? Blume.

11. *C. tetrapetala*, (Roxb.) "Leaves short petioled, oval, lanceolate, very finely serrulate: umbels axillary: corolla 4-petaled." Roxb. Fl. Ind. 608.

Moluccas.—Of this species I know nothing beyond what is expressed in the above brief character.—It however belongs to this section, as he considers all the leaves of the pereanth petals, and characterizes the genus as having an 8 petaled corolla.

Species imperfectly known.

12. C. *surega*, (Buch. Roxb.) "Leaves linear, oblong, flowers verticelled below the leaves." Roxb. Fl. Ind. 2-608.

13. C. ? *lanceolarium*, (Roxb. Fl. Ind. 2-608.) "Twigs square, leaves lanceolar, obtuse, lucid, finely veined" (acute at the base, *Blume*) Roxb. l. c. *C. lanceolatum.* Blume, Bijd. 1-217.

Muritias.—Neither Roxburgh nor Blume have seen the flowers of this plant, our knowledge of its genus is therefore only conjectural.

14. C. *polyanthum*, Wall. L. 4844.
15. C ? *marginatum*, 4845.
16. C. *relusum*, 4846.
17. C. *pulcherimum*, 4848.
18. C. *amœnum*, 4849.
19. C. *mesuæfolium*, 4850.
20. C. *longifolium*, 4851. " *Certe non hujus generis.*" (Wall.)

KAYEA—Wall.

Sepals 4, petals 4. (scarcely longer than the calyx) Stamens numerous, filaments united at the base; anthers orbicular, cells curved round the edge of a broad circular connectivum. Ovary free, 1-celled, with several (4) erect ovules attached to the base. Style one, stigma 4-lobed. Fruit—.

A very large handsome tree, young shoots slightly 4-sided—leaves opposite, approximated towards the ends of the branches, coriaceous, linear, lanceolate, acute. Panicles axillary and terminal, many flowered, congested near the ends of the branches, and forming by their union large terminal panicles.

K. floribunda, Wall. Pl. As. Rar. 3, page 5, tab. 210.

This genus is very nearly allied to *Calophyllum*, agreeing with it in habit, inflorescence, and generally, in the structure of the flowers. But in this the connectivum of the anther is dilated so that the pollen cells, in place of being approximated and parallel to each other, are remote and bent, being curved round its edges: and the ovary, in place of one, has four erect ovules. The two together form very sufficient grounds for keeping the genera separate. *Kayea* in short, stands in the same relation to *Calophyllum* that *Gynotroches* does to *Garcinia*. The cells of the ovary of *Gynotroches* have 3 ovules, while they are solitary in *Garcinia*. The ovary of *Kayea* has 4 ovules, while in *Calophyllum* it is solitary.

One plant appertaining to this order, yet remains to be noticed, though rather imperfectly known, as it evi-

dently forms the type of a new genus, and, so far as can be made out from male flowers only, clearly referable to this suborder.

The most striking peculiarity I have observed in this is the æstivation of its calyx, which seems valvate, and not imbricated as in all the other genera of the order, and is the only point that gives rise to the slightest doubt as to the order to which it belongs. But this anomaly may be explained, I think, on the supposition that two of the four sepals, usually present in the order, abort, and that the remaining two, as happens with the exterior sepals of *Kayea*, have a valvate æstivation. Another circumstance that strikes me as peculiar, is, that the union between the sepals is so very intimate, as not to present any indication of the place where it occurs—hence the corolla and stamens before anthesis have the appearance of being inclosed in a bag, the more so, as the calyx, which is thin and membranacious, is when moistened, as pliable as wet bladder. During anthesis, it splits into two equal halves, displaying 4 petals and numerous stamens, but in the male flowers, no trace of a pistil—the genus may be thus designated and defined.

Calysaccion, R. W.

Flowers unisexual. *Male*—Sepals (2 ?) intimately united (forming a closed sac) in æstivation. Petals 4, imbricating. Stamens very numerous, sub-monadelphous at the base, filaments short, slender: anthers oblong, 2-celled: cells approximated parallel, opening lengthwise, connectivum slightly prolonged and truncated at the apex. Pistil altogether wanting.—*Female.*

Arborious, young shoots terete or slightly 4-sided, leaves glabrous, opposite, short petioled, linear lanceolate, obtuse, thick, hard and coriaceous, marked with a prominent costa, but without transverse parallel veins. Flowers numerous, congested on lateral tubercles, springing from the axils of fallen leaves (abortive branches) forming dense lateral capitulæ, peduncles short, 1-flowered.

C. *longifolium*, R. W.

Malabar near Bombay.

I am indebted to J. Graham, Esq. of Bombay, for my specimens of this plant, which he thought, might be the *Calophyllum longifolium* of Wallich's list mentioned above as " *certe non hujus generis.*" As this conjecture seems not improbable, I have adopted that specific name. The genus so far as its affinities can be made out from the male flower only, is most nearly allied to *Kayea*, but wants the inner pair of sepals, and the outer ones are very different in texture, which, added to the difference of the anthers, and habit, throw almost insurmountable difficulties in the way of its being admitted into that family, and fully bear me out in considering it a new and distinct genus.

EXPLANATION OF PLATE 44.

Hebradendron Cambogioides, (Graham.) *Garcinia gutta*, (R. W.) page 126.

A. Flowering branch, (female)—B. The same in fruit—*natural size.*

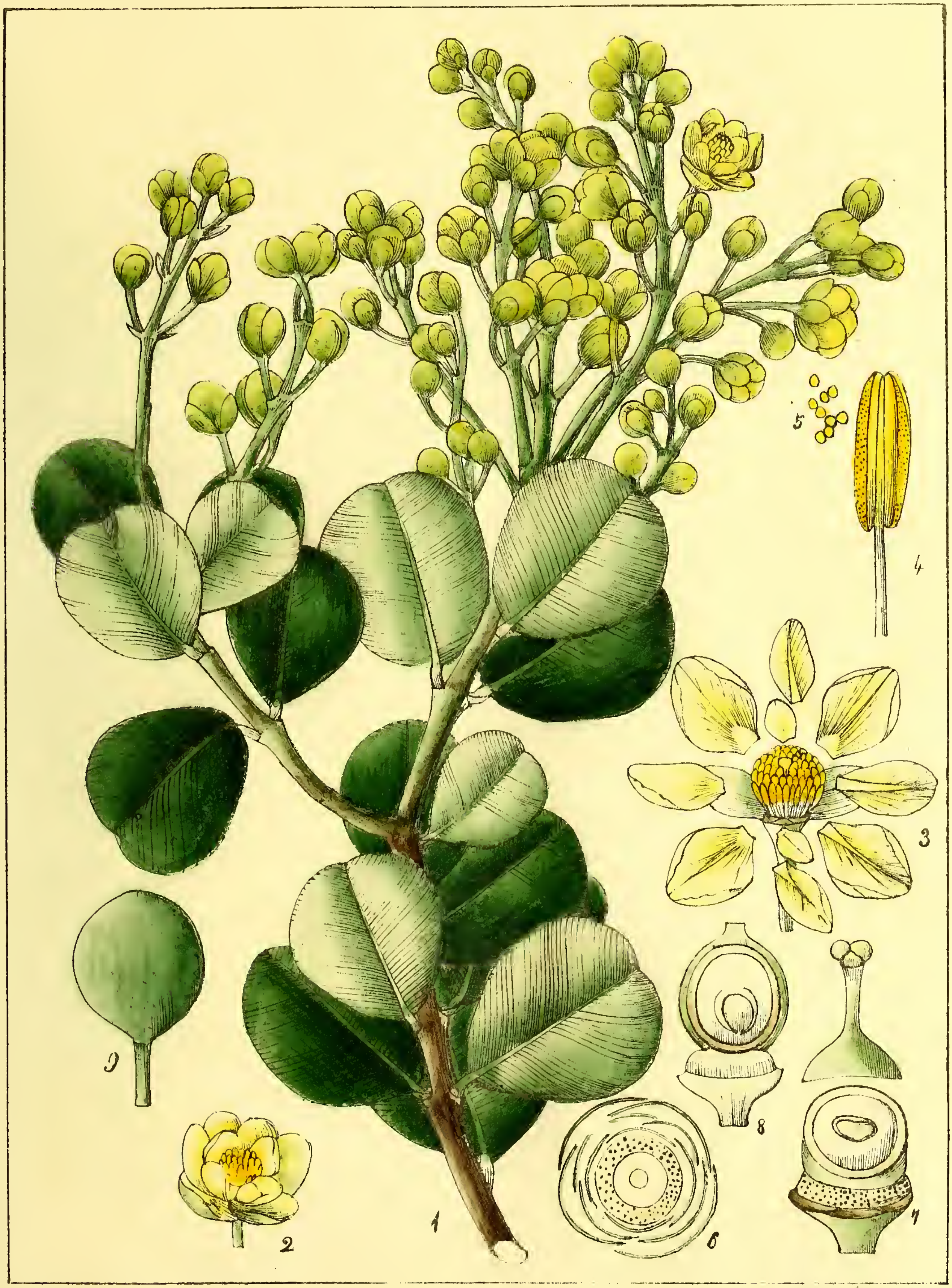
1. Female flower.—2. Stigma removed.—3. Male flower front view.—4. Side view of the same, the petals removed to show the staminal column.—5. Back view of the same.—6. Column of stamens taken from a flower-bud.—7. An anther before dehiscence—*all more or less magnified.*—8-9. Full grown fruit cut transversely and vertically—*natural size.*

EXPLANATION OF PLATE 45.

Calophyllum Walkerii, (R. W.) *natural size.*—2. A detached flower—*natural size.*—3. The same dissected, showing each piece.—4. An anther.—5. Grains of pollen.—6. A diagram of the æstivation.—7. Ovary, style, and stigma, the ovary cut transversely.—8. The same cut vertically.—9. A fruit—*natural size—all with the exceptions mentioned, more or less magnified.*

P. S.—After this article was completed and the greater part of it printed, I received Lindley's " Flora Medica" a new work just issued from the press, and like all the other works of the accomplished author forming a most valuable contribution to Botanical science; on this occasion in connection with medicine. In this work I find Dr. Lindley has added the weight of his authority, to that of those who adopt Murray's *Stalagmitis* in preference to Roxburgh's *Xanthochymus.* This he does for the reasons adduced by Dr. Graham, namely, that Mr. Brown had examined Murray's specimen and ascertained that it consists of two plants, probably of two genera, one of which, in flower, is a *Xanthochymus*, the other, not in flower, supposed to be Graham's *Hebradendron.* Having expressed my belief that *Xanthochymus* does not belong to this natural order, and having no new species to add, nor other information to communicate respecting it, I did not intend to have noticed that genus in this place. But as I have said above that in my opinion *Stalagmitis* ought to be suppressed and *Xanthochymus* established in its room, I feel now called upon to state more fully my reasons for thinking so—I shall commence by extracting from the " Botanical Magazine Companion" the passage of Mr. Brown's letter, quoted by Dr. Graham as his authority, for saying that the generic name *Xanthochymus* must be dropped in favour of *Stalagmitis.* " The plant sent pasted by König to Sir Joseph Banks, as one specimen, I have ascertained to be made up of two plants, and very probably of two genera. The union was concealed by sealing wax. The portion in flower, and which agrees in structure with Murray's account, is, I have no doubt, the *Xanthochymus ovalifolius* of Roxburgh.

HEBRADENDRON CAMBOGIOIDES (*Graham*)



Kungia del — Winckistler Lith

Calophyllum Walkerii (R.W.)

Stalagmitis and *Xanthochymus* are therefore one genus, as Cambessides has already observed, giving the preference to the earlier name of Murray. This, however, forms but a small part of the whole specimen, the larger portion being, I am inclined to think, the same with your plant, of which I have seen, and I believe still possess, the specimen you sent to Don.* The structure, however, of this greater portion cannot be ascertained from the few very young flower-buds belonging to it. It approaches also very closely, in its leaves especially, to that specimen in Hermann's herbarium, which may be considered as the type of Linnæus' *Cambogia gutta.* A loose fruit, pasted on the sheet with König's plant, probably belongs to the larger portion, and resembles "Gærtner's Morella."

So far all appears clearly in favour of *Stalagmitis*, and had Murray in drawing up his character rigidly confined himself to the description of the flowers before him, I should at once have adopted his name in preference to Roxburgh's. But on turning to his character, as given in Schreber's genera plantarum, we find a 4-leaved calyx, a 4-petaled corolla, and a 4-lobed stigma, combined with pentadelphous stamens, 3-seeded berries, the stigmas sometimes trifid: stamina not always polyadelphous? &c. From this very unusual combination of quinary and quaternary forms I am led to infer that the character is only partly derived from the specimen, and partly, if not principally from notes communicated by König, who, it appears, from the fact of his having combined, on the supposition that they were the same plant, two distinct species, was not aware of the difference, and misled Murray by communicating written characters of a *Garcinia*, and flowers of another plant, and between the two, there has resulted a set of characters not likely to be often found combined in the same species and still less frequently in one small specimen. Roxburgh on the other hand briefly and clearly defines a genus of plants well known to him, and extensively distributed over India, about which he has scarcely left room for a mistake. If further proof be wanted in support of the opinion I have advanced that this is a hybrid genus, I adduce Cambessides, whose authority is quoted for the identity of *Stalagmitis* and *Xanthochymus.* He has strictly followed Murray, adopted all the contradictions of his character and constituted a genus embodying, first, Roxburgh's genus *Xanthochymus*, next, Petit Thours' *Brindonia*, evidently identical with *Garcinia*, then Loureiro's *Oxycarpus*, also *Garcinia*, and lastly, (if I am not misled by Mr. George Don, whom I am obliged for want of Cambessides' own memoir to follow) nearly the whole of Roxburgh's species of *Garcinia*, as if Roxburgh was so bad a Botanist as not to be able, with growing plants before him, to distinguish between two genera so very distinct as *Garcinia* and his own *Xanthochymus*. In a paper which I published in the *Madras Journal of Science* for October 1836, I showed from the internal evidence afforded by the two sets of characters that Murray's *Stalagmitis* and Roxburgh's *Xanthochymus* were partly identical, and attributed the discrepancies to defects of Murray's solitary specimen, a view, which Mr. Brown has shown to be only partly right by proving that they in some measure originated in the imperfect observation of König, who supplied Murray with the materials for his genus.

Having now adduced what I esteem conclusive evidence in support of the opinion I advanced above, that Murray's genus is spurious, and that of Cambessides founded on it, is most unnatural, as associating species that never can combine generically: while Roxburgh's, is a strictly natural genus including several nearly allied species, and moreover, probably referable to a natural order different from more than half of the species referred to it under the name of *Stalagmitis* by Cambessides, I consider myself fully justified in continuing to adopt the generic name *Xanthochymus* (even though opposed by the highest Botanical authorities) until careful examination of the original specimen, with reference to the elucidation of the discrepancies I have indicated, shall have proved, that such actually exist in *that* specimen. If they do exist, then the fault is not Murray's and his name must of right be adopted with an amended character, excluding the numerous species of *Garcinia* brought under it by Cambessides: if they do not, Roxburgh's genus, which as it now stands is strictly natural, claims the preference.

* One of those received from Mrs. Walker.

XXXIV.—HIPPOCRATEACEÆ.

A small order of tropical arborescent or climbing shrubs, with opposite, simple, undivided, toothed, or entire, somewhat coriaceous leaves, and small deciduous stipules. The flowers are small, bisexual, regular, arranged in racemes, corymbs, or axillary fascicles.

The calyx consists of five, or very rarely four or six, small persistent imbricating sepals. The corolla is composed of five, equal, inferior petals, alternate with the sepals, slightly imbricated in æstivation. There are only three stamens, by some the filaments are described as distinct, by others they are said to be free above, but dilated and usually cohering at the base, forming a cup or disk-like covering to the ovary. Anthers terminal, one or 2-celled, in the former case opening transversely across the apex, in the latter longitudinally. Ovary superior, hid under the disk of the filaments, 3-celled, with several superposed ovules in each, either ranged in a single or double row, and attached to the axis: styles 3 cohering into 1: stigmas 3 united, or distinct. Fruit either baccate with one or several seeds, or composed of three samaroid 2-valved carpels. Seeds exalbuminous, embryo straight, radicle pointing to the base, sometimes winged, cotyledons flat, elliptical, oblong, somewhat fleshy.

Affinities. These are uncertain, some Botanists considering this order more nearly allied to *Acerineæ* and *Malpighiaceæ*, while others at the head of whom is the celebrated Brown, and Dr. Lindley assert they are scarcely to be distinguished from *Celastrineæ;* the latter Botanist even reduces this to a suborder of *Celastrineæ.* Bartling places these two orders next each other, while Meisner on the other hand retains this order in his class *Malpighinæ* in the vicinity of *Malpighiaceæ,* and *Erythroxyleæ.* To me it appears that in a strictly natural distribution of the orders it should rank near *Celastrineæ,* if not, as Dr. Lindley has done, form a section of that order, but so long as the orders themselves, are distributed according to an artificial arrangement depending on the insertions of the petals and stamens, whether hypogynous or perigynous, I fear it must be retained in its present place. In itself, the order does not seem well constituted, as resting on a peculiarity of structure which I cannot help viewing as of secondary importance, the unsymmetrical (ternary) stamens and dilated cohering filaments, while the fruit, which generally affords more valuable characters, differs most widely in the different genera. The characters however derived from the relative number of stamens and sepals, added to the very unusual development of the filaments are so very singular, as well to entitle them to a degree of importance not usually accorded to them, and even to raise them superior, in this particular instance, to those taken from the peculiarities of the fruit and structure of the seed, and, for the same reason that they unite *Salacia* with a baccate fruit and *Hippocratea* with three samaroid carpels, exclude *Celastrineæ,* though in both orders " the insertion of the ovules is either towards the base, or is central, and the direction of the radicle is always inferior" as observed by Mr. Brown.

Geographical Distribution. This order is altogether of tropical origin, the larger portion appertaining to America. Some species of *Hippocratea* and *Salacia* are found in Africa, and several more of both in India. Hitherto, these two genera only, have been met with in India, but are very generally diffused over it, and so abundant, that species of one or other are to be found in almost every jungle.

Properties and Uses. I am not aware of any use to which any of the Indian species of this order has been applied. The fruit of one African species *Salacia pyriformis* is eatable, its flavour is said to be rich and sweet. The seeds of *Hippocratea comosa,* a West Indian plant, are oily and sweet.

Remarks on Genera and Species. The Indian flora as already remarked only furnishes species of two genera, *Hippocratea* and *Salacia.* They are easily distinguished when in fruit by the 2-valved capsular carpels of the one, and the pulpy baccate fruit of the other. In flower they are not quite so readily distinguished, but may be by the anthers which are 1-celled, bursting across the apex in the former, and 2-celled opening lengthwise in the latter, and generally still more easily by the inflorescence which is panicled in *Hippocratea,* while

in *Salacia* the flowers are for the most part congested in the axils of the leaves. Of this order Roxburgh seems only to have known five species, three of *Hippocratea* and two of *Salacia*, or *Johnia* as he, supposing them a distinct genus, called them. Under Wallich's hands the number has swollen to 19, but whether these will all prove distinct when thoroughly examined and compared may be doubtful, as some of them vary considerably according to circumstances.

It is not improbable that the species of *Hippocratea* here figured may be one of them, but as it was impossible for me to determine that from a name only, and as it evidently differs from all those described by Roxburgh, I could not hesitate about naming it. I have another species from Bombay, communicated by Mr. Graham under the name of *H. obtusifolia.* It does not however correspond with my specimens of that species nor indeed with any of the other Indian ones with which I am acquainted. From *H. indica* these three species are all known at a glance by their larger sized flowers; from each other they may be thus distinguished. *H. obtusifolia,* calyx fleshy, entire on the margin, petals triangular, tapering to a point. *H. Grahamii,* calyx membranous, fimbriated on the margin, petals obovate—spathulate. *H. Arnottiana,* calyx fleshy, lobes obtuse, entire on the margin, petals suborbicular, unguiculate, reflexed. *H. Richardiana* of the Flora Senegambiæ, if really distinct, must be very closely allied to our *H. obtusifolia,* (I suspect they are the same species) the figure of *H. paniculata* of the same work, shows that it more nearly approaches my *H. Grahamii,* but is quite distinct.

The species of *Salacia* cannot, so far as I have yet been able to ascertain, be thus briefly and clearly distinguished by the flowers. The fruit seems to afford better distinguishing marks but is often wanting in preserved specimens. The inflorescence also gives several pretty good characters such as, whether the peduncles have one or several flowers, whether in the former case, there are few or many aggregated in the axil of the leaf, and whether they are longer or shorter than the petiol—according to these marks they may be thus distributed.

1.—Peduncles 1-flowered—(from an axillary tubercle).

A. Peduncles few—(1 or 2 to 6 or 8).

S. Brunoniana. S. Roxburghii. S. prinoides. S. macrophylla, Blume, one from Ceylon, *S. reticulata,* R. W. one and lastly, *S. senegalensis* distinct, from Malabar, though for the present united with the Ceylon one, D. C.

B. Peduncles very numerous.

Two species from Mergui of which I have specimens are referable to this subsection—both, so far as I know, undescribed. *S. verrucosa,* R. W. and *S. multiflora,* R. W.

These two subsections are perhaps too artificial to prove of much value in practice, as it is evident that change of circumstances may cause a species to pass from the one into the other.

2.—Peduncles several flowered.

A. Peduncles 2-3 cleft, bearing few subsessile flowers on the apex.

S. pomifera. S. oblonga. S. Javanensis, Blume. *S. oblongifolia,* Blume. *S. melitocarpa,* Blume.

B. Peduncles forked, each division terminating in a simple many flowered umbel, flowers longish, pedicelled.

To this subsection one Mergui species *S. floribunda,* R. W. belongs.

The new species of both genera of this enumeration may be thus designated and defined.

HIPPOCRATEA.

H. Arnottiana, (R. W.) Shrubby, twining, glabrous, leaves ovate, oblong, acuminated, coriaceous, remotely crenato—serrated on the margin; panicles small, few flowered, axillary and terminal: petals from broadly ovate obtuse to subreniform, unguiculate, carpels linear, spathulate, broadly emarginate at the apex.

Hab.—*Malabar.*

The flowers of this species are perhaps, about the

largest of the genus, and the form of the petals at once distinguishes it from the other four Peninsular species.

H. Grahamii, (R. W.) Shrubby, twining, glabrous, leaves coriaceous entire, from broadly ovate to suborbicular, acuminated: panicles numerous, large, many flowered, congested towards the summits of the branches, petals linear spathulate, obtuse, carpels obovate, obtuse, slightly emarginate.

H. obtusifolia, Graham's MSS.

Hab.—*Bombay.*

I am indebted to Mr. J. Graham, of Bombay, for my specimens of this very distinct species, which is at once distinguished from *H. obtusifolia*, by its obtuse spathulate, not ovate acute petals, and more easily by its long peduncled, contracted many flowered, not diffusely spreading panicles.

SALACIA.

A. *Peduncles one flowered, few.*

S. reticulata, (R. W.) Shrubby, twining, leaves oval or somewhat obovate, attenuated at the base, ending in a short blunt acumen, coriaceous, serrulate, reticulated (when dry) with numerous prominent veins: peduncles shorter than the petiols: petals ovate, broad at the base, attenuated upwards, exunguiculate, fruit large globose warty?

Ceylon and Malabar? partly communicated by Colonel Walker.

The Malabar plant above alluded to may belong to this species, but is not in flower. The leaves are similar in form but less distinctly reticulated, which may perhaps be attributable to age, if identical, the fruit is as large as a small apple, rough and warty on the surface, and from it I have added, with a doubt, the character of the fruit. This species is very nearly allied to *S. prinoides*, but is certainly distinct if the fruit I have described belongs to it, should it prove otherwise, it is distinguished by the form of the petals, which in this are broad at the base, tapering to the point and without a claw, in that, from broad ovate very obtuse, to suborbicular and with a claw.

B. *Peduncles one flowered, very numerous.*

S. verrucosa, (R. W.) Shrubby, bark of the flower-bearing branches everywhere rough, with small warty excrescences: leaves coriaceous, entire, lanceolate, acute at the base, ending above in a short blunt acumen; peduncles 1-flowered, very numerous, arising from prominent axillary tubercles, shorter than the petiols: petals broad at the base, exunguiculate, oblong, obtuse: ovules two, superposed, in each cell: fruit?

Hab.—*Mergui.* Communicated by Wm. Griffith, Esq.

The bark of the flower-bearing branches in this species are quite rough from the numerous small warty excrescences, the leaves which are very firm and coriaceous are from 4 to 6 inches long, and barely 2 broad at the broadest part; and the flowers, the clusters of which are nearly opposite, are so numerous as to form complete verticels.

S. multiflora, (R. W.) Shrubby, glabrous, leaves broadly ovate, lanceolate, rounded at the base, slightly acuminated and obtuse at the apex, coriaceous, quite entire: peduncles numerous, from axillary tubercles, 1-flowered, longer than the petiols: calyx deeply 5-cleft: petals orbicular, ovules about 8 in each cell of the ovary in two collateral rows: fruit?

Hab.—*Mergui.* Communicated by Wm. Griffith, Esq.

The leaves of this very handsome species dry of a pale green in place of, as in most others of a dark brownish green: they are from 8 to 10 inches long by about 4 broad, quite entire, and in the dried plant, slightly revolute on the margin. It appears a very distinct species and remarkable for having a double row of ovules as in *Hippocratea*, with the cells of the anthers placed transversely across the apex of the filament and opening outwardly, hence, when the fruit is known it may form the type of a new genus.

Peduncles forked, divisions umbellately, many flowered.

S. floribunda, (R. W.) Shrubby, scandent, glabrous: leaves elliptical, obtuse at both ends, sometimes ending in an abrupt blunt acumen, very slightly crenate on the margin: peduncles axillary, solitary, nearly as long as the petiols, once or twice forked at the apex, each division ending in a dense cluster of small longish pedicelled flowers: calyx entire, 5-toothed: petals small, orbicular, reflexed: ovules 2 in each cell, collateral fruit?

Mergui.—Communicated by Wm. Griffith, Esq.

The compound inflorescence of this species gives rise to a suspicion that it might be a *Hippocratea*, but the decidedly 2-celled anthers forbids me entertaining such an opinion, unless supported by the presence of fruit in which my specimens are deficient.

EXPLANATION OF PLATES 46 AND 47.

46—1. Hippocratea Arnottiana, R. W. *natural size.*

47—A. 2. An expanded flower of the same.

3. An anther, showing it 1-celled.

4. The ovary cut transversely 3-celled, with two ovules in each cell.

5. A mature capsule burst, showing the contained seed.

6. A seed removed, showing the downward direction of the wing.

7. A seed cut transversely.

8. The seed removed and divided longitudinally, to show the inferior radicle and embryo—*all more or less magnified.*

47—B. 1. Salacia oblonga—an expanded flower.

2. The same, the sepals forcibly opened and the petals removed to show the superior ovary and the disk-like expansion of the filaments.

3. Stamens showing the anthers 2-celled.

4. A diagram of the flower.

5. The ovary cut transversely.

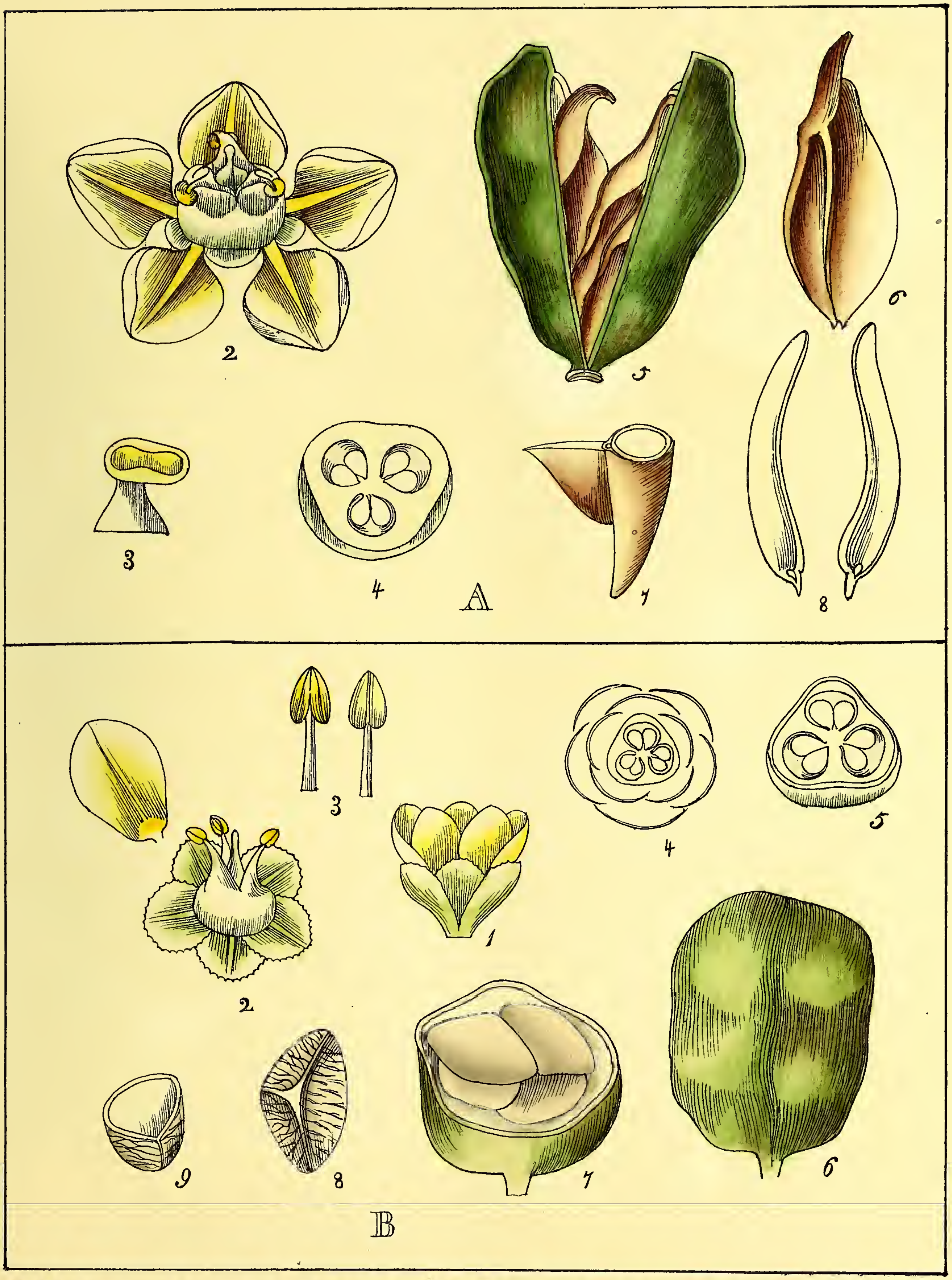
6. A full grown fruit, *natural size.*

7. The same cut transversely, *natural size.*

8. A seed, the adhering pulp removed.

9. The same cut transversely—*with the exceptions mentioned; all more or less magnified.*

HIPPOCRATEA ARNOTTIANA (R.W.)



A. HIPPOCRATEA ARNOTTIANA | B. SALACIA OBLONGA. (WALL.)

XXXV.—ERYTHROXYLEÆ.

This is one of the smallest orders of the Indian flora, being at the time we published the Prodromus limited to one Peninsular species, the one here figured, one or two others have since been found on the continent, and one in Ceylon. The species are generally shrubs or small trees, with ascending branches, the young shoots of which are often compressed and covered with acute imbricated scales. The leaves are alternate or rarely opposite, glabrous, with axillary stipules. The flowers are small, axillary, solitary, or several together, whitish or greenish, the peduncles furnished with bracts at the base.

Calyx free, persistent, 5-parted: torus inconspicuous: petals 5, hypogynous, equal, alternate with the lobes of the calyx, broad at the base, and furnished with a plaited scale within, stamens 10, hypogynous, filaments united at the base: anthers erect, 2 celled, cells opening longitudinally by a lateral slit. Ovary 3-celled, two often imperfect or empty, with a solitary pendulous ovule in each: styles 3, distinct, or rarely cohering: stigmas capitate. Fruit drupacious, 1-seeded, albumen horny. Embryo linear, straight: radicle superior round, straight. Cotyledons linear, foliaceous.

Affinities. This order was separated from *Malpighiaceæ* by Kunth, on account of the appendages of the petals, the presence of albumen in the seed, the fruit being often 1-celled by abortion, and the peculiar habit. These however in the estimation of Dr. Lindley do not appear peculiarities enough to constitute it more than a subdivision of *Malpighiaceæ*, on which account he has restored it to that family as a suborder. In the propriety of this distribution I am inclined to coincide, though my limited acquaintance with this order, precludes my adopting it.

Geographical Distribution. The West Indies and South America appear to be the head quarters of this order, but some species are found in the Mauritius and Madagascar, and a few (6 or 8) in India. The only species I have met with in Southern India are, the one here figured, and two from Courtallum, I have besides specimens of another from Ceylon, which I named *Sethia acuminata,* on account of the long acumen which terminates its elliptic oblong leaves.

Properties and Uses. The only notice I find under this head refers to a single South American species, the *Erythroxylon coca,* of which there is a very detailed account in Hooker's Companion to the Botanical Magazine. According to the writer of that paper, its effects are fully as deleterious as those of opium. The following extract from Lindley's Flora Medica, gives an abbreviated summary of its effects.

" A powerful stimulant of the nervous system, affecting it in a manner analogous to opium. Less violent in its effects than that drug, but more permanent in its action. The Peruvians chew the leaves with finely powdered chalk, and the government of Potosi alone, derived a revenue of as much as 500,000 peso duros in the year 1583, from their consumption."

Remarks on Genera and Species. Two genera only are referred to this order, *Erythroxylon* and *Sethia,* and of the last only 3 or 4 species are known. Three are natives of southern India, and one from Ceylon. The continental ones may be thus briefly characterized. *S. indica,* leaves obovate, cuneate, styles united to the apex—*S. lanceolata,* leaves lanceolate, cuneate towards the base, styles united two-thirds of their length—*S. erythroxyloides,* leaves lanceolate, styles free to near the base, short. Dr. Lindley in the second edition of his natural system of Botany, with great propriety, in my opinion, reduces the last of these as being separated on too trivial grounds, the union of the styles, a mark, which I cannot consider of generic value, though, for the sake of preventing unnecessary disturbance of established names, I have here retained it. Mr. Arnott gives the following character of the Ceylon one in his Pugillus Plantarum Ind: Orientalis.

Sethia acuminata, (Arn.) Leaves alternate, elliptic oblong, acute at the base, suddenly acuminated at the point, penninerved, paler beneath, pedicels axillary, about a half longer than the petiols, solitary, 1-flowered, calyx 5-cleft, segments ovate, acute, the styles cohering almost to the apex, stigmas globose.

Hab.—*Ceylon.*

My specimens, to which I had previously given the same specific name, accurately correspond with this character.

Sethia lanceolata, (R. W.) Leaves lanceolate, obtuse, short petioled, peduncles axillary, solitary, about thrice the length of the petiols, styles longer than the stamens, united about two-thirds of their length, free, and recurved at the apex, stigmas globose.

Var. β. obtusifolia. Leaves from elliptical tapering slightly towards the base to obovate, cuneate.

Hab.—*Courtallum in thick jungles.*

These two varieties are probably distinct species, but as the form of the style and stigmas is the same in both, I prefer keeping them together, though they look different. In the first the leaves are long and narrow in proportion to their length, that is, from 2½ to 3 inches long, by about ¾ of an inch in breadth: while in the other they are about 1½ inch in length, and ¾ to 1 inch in breadth, and the stipules which sheath the ends of the young shoots are larger.

Sethia erythroxyloides, (R. W.) Leaves oblong, lanceolate, coriaceous, slightly retuse at the apex, subsessile: peduncles axillary, solitary, three or four times the length of the petiols: styles shorter than the stamens, free, nearly to the base; stigmas recurved, clavate.

Hab.—*Courtallum in thick jungles.*

This species is very closely allied to the former, but the marked difference in the styles and stigmas forbid their being united.

EXPLANATION OF PLATE 48.

1. Sethia indica, *natural size.*
2. An expanded flower.
3. The same, partially dissected with a detached petal, showing the scale at the base.
4. The stamens removed to show the union of the filaments.
5. Detached stamens back and front views.
6. The ovary cut transversely, the upper half with the style and stigmas attached.
7. The same cut vertically, showing the pendulous ovary.
8. A mature fruit, *natural size.*
9. Cut transversely, two of the cells empty.
10. Cut vertically, showing the form of the seed.

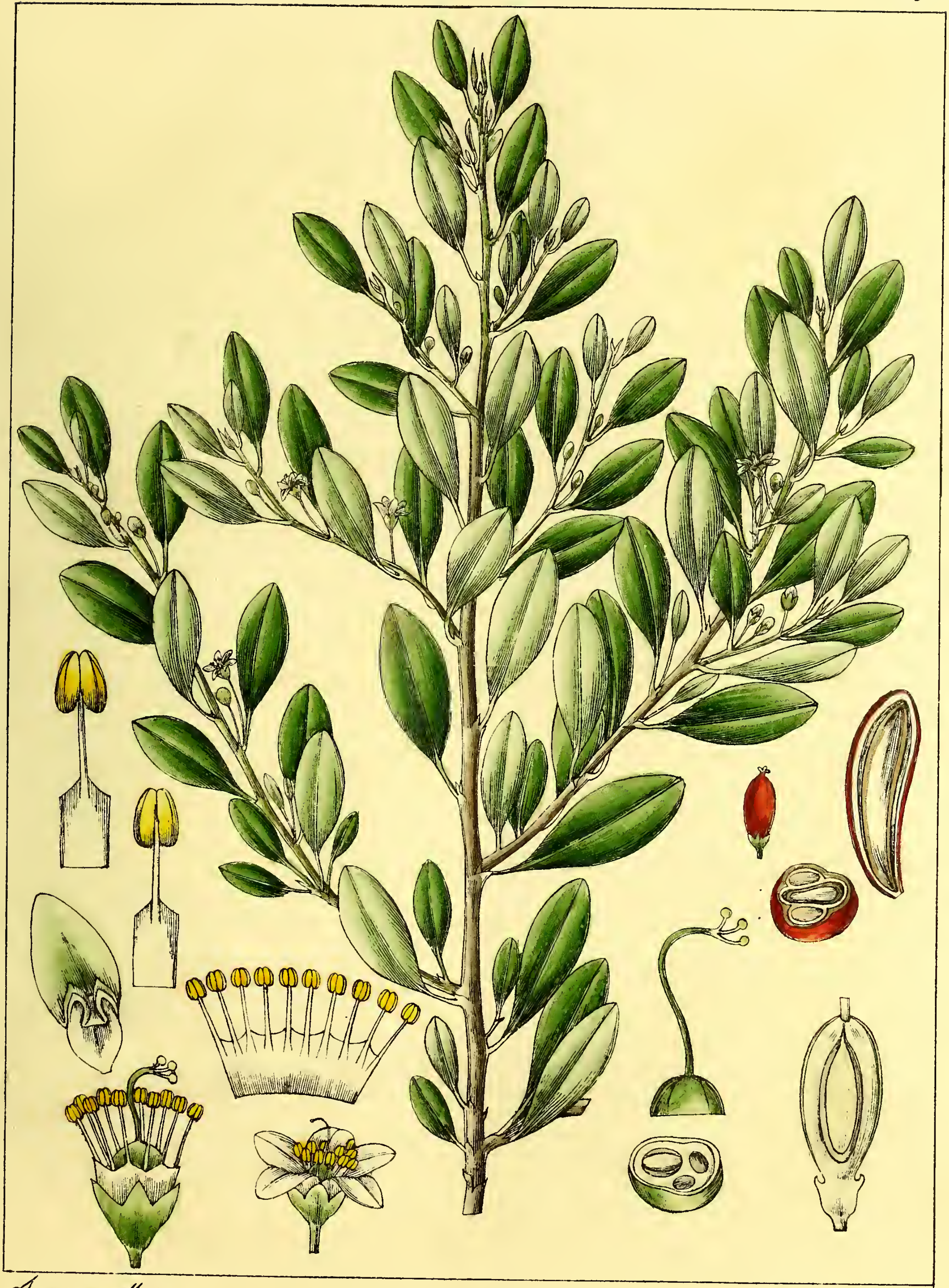
Obs.—Owing to an oversight the numbers were not added in this plate, those here given are what ought to have been, and may be yet supplied with pen and ink.

XXXVI.—MALPIGHIACEÆ.

A rather large order of tropical plants but principally confined to America, a very few being found in India, and these not of common occurrence. The greater number of Indian species are scandent shrubs, with jointed branches and opposite simple entire leaves, without dots, and minute stipules, some species of the order are clothed with appressed stinging bristles, others with silky pubescence. The flowers are for the most part bisexual, regular, racemose, or corymbose, rarely solitary, the pedicels often jointed in the middle and furnished with bractiols.

Calyx 5-sepaled, free or slightly united, persistent, imbricated in æstivation, and furnished with a definite number of conspicuous glands. Petals 5 unguiculate, inserted on a discoid torus, sometimes unequal, seldom wanting. Stamens 10, rarely fewer, filaments either distinct or partly united at the base, anthers roundish, 2-celled, opening by longitudinal lateral slits, introrse. Ovary usually 3-celled, occasionally more or less distinct, ovules solitary, pendulous, styles 3 distinct, or cohering into one. Fruit berried or dry, 3-celled, or by abortion, 2 or 1-celled and 1-seeded, often with the middle of the back expanded into a wing, seeds pendulous, attached to the central axis of the carpel, exarillate, albumen none. Embryo curved or straight: radicle superior, short. Cotyledons foliaceous, or fleshy.

Affinities. The affinities of this order do not seem to be very clearly defined, at least I do not find them so in any work I can refer to. They are distinguished from *Acerineæ* by their unguiculate petals, glandular calyx, and symmetrical flowers: but in *Erythroxyleæ*, which, as stated above, are considered a mere section of *Malpighiaceæ*, the petals are sessile, and in *Hiptage*, the claw is so short as scarcely to deserve notice. Here however the position of the ovules assists to distinguish them, being pendulous in this, erect in *Acerineae*. It is said that those genera of *Hippocrateaceæ* which have samaroid fruit have sessile petals, this is not a good distinction, since in *H. Arnottiana*, the claws of the petals are, in proportion to their size, fully as long as those of *Hiptage*, the direction of the radicle, however, is different, being in this superior, in that inferior; from which it would appear, that *Malpighiaceæ* are only distinguishable from *Hippocrateaceæ* and other allied orders " by the radicle of the embryo being uniformly superior," while in them it is inferior. Meisner in his *Plantarum Vascularium Genera* combines into his class *Malpighinae* the following orders, *Hippocastaneae*, *Sapindaceae*, *Malpighiaceae*, *Acerineae*, *Erythroxyleae*, *Hippocratiaceae*, and ? *Corearieae*, the characters of which



Semmanuttee
செமமனுத்தி
Dava dharee
தேவதாரி

SETHIA INDICA.

Udwi-gorinta-T.

I give below in his own language, as presenting in few words perhaps the best and clearest view yet published of the distinctive marks of these very nearly allied orders.

MALPIGHINÆ. *(Classis).*

Conspectus ordinum.

A. Germen conflatum ex ovariis 3 v. 2, plus minus inter se connatis.
 I. Stamina calycis laciniis aequalia v. plura, plerumque dupla (rarissime in Malpighiaceis pauciora). Germinis loculi 1-2- (raro pluri-) ovulati.
  † Semina exalbuminosa.
   a. *Semina hilo lato aut arillo praedita.* Folia plerumque composita.
    1. *Folia opposita* exstipulata palmatim 5-00-foliolata. Thyrsi terminales. Cirrhi 0. Flor. irregulares. Stam. 7, rarius 6 v. 8. Germ. 3-loc., loc. 2-ovulat., ovulo superiore pendulo inferiore adscendente. Caps. aptera, loculicide 3-2-valv., 3-1-sp. Sem. exarill., hilo maximo.—*Hippocastaneae.*
    2. — *alterna,* pinnata aut pinnatisecta, rarius simplicia integra, rarissime stipulata. Pedunculi axillares, saepe cirrhigeri. Flores regular. v. irregul. Stam. petalor. numero dupla, duobus saepe deficientib. Germ. 3-2-loc., locul. 1-3-ovul., ov. adscendent. Drupa v. caps., carpellis saepe samaroideis.—*Sapindaceae.*
   b. *Semina nec arillata nec hilo lato insignia,* pendula aut adscendentia. Fol. plerumque simplicia.
    1. *Semina ope funiculi pendula,* solitaria. Ovaria 3, interdum distincta. Carpella saepissime alata, rarius carnosa. Calyx persist., basi extus saepe glandulosus. Stam. 10, rarissime pauciora. (Fol. opposita, rarissime alterna, simplicia, interdum lobata, saepe stipulata.)—*Malpighiaceae.*
    2. — *adscendentia, sessilia.* Ovaria 2, connata. Carpella extrorsum alata, samaroidea. Calyx decid., eglandulos. Stam. 5-12, saepius 8. (Fol. opposita, simplicia, plerumque lobata, rarius impari-pinnata. Stipulae 0.)—*Acerineae.*
  †† Semina albuminosa, solitaria. Fruct. drupaceus, abortu 1-loc. Germ. 3-loc., loc. 1-ovulatis, duobus subevanidis. Ovulum pendulum. Cal. persist. Pet. 5. Stam. 10, basi monadelpha. (Fol. alterna, rarissime opposita, simplicia, integra, saepe triplinervia. Stipulae 2 persist. intra axillam connatae in unicam saepe 2-fidam.)—*Erythroxyleae.*
 II. Stamina 3 (antheris saepe 1-locular.). Cal. 5-divisus, persist. Pet. 5. Germ. 3-loc., locul. biseriatim pluriovulatis. Styli 3 connati. Carpella 3, v. abortu 2-1, samaroidea, 2-valvia, aut baccata, oligosperma. Sem. adscendent., exalbum. (Fol. oppos., simpl., indivisa. Stipulae parvae, deciduae.)—*Hippocrateaceae.*
B. Germen conflatum ex ovariis 5 connatis, 1-ovulatis, ov. pendulis. Stigm. 5, sessilia. Carpella demum subdistincta, indehiscentia. Sem. exalbum. Cal. persist. 10-fid., lobis 5 interioribus callosis minoribus. Petala 0. Stamina 10, libera. (Fol. oppos., simpl., integra, 3-5-nervia, exstipulata.)—? *Coriarieae.*

GEOGRAPHICAL DISTRIBUTION. I have remarked above that this is a strictly tropical order, but principally confined to America, so much so indeed, that of 180 species described by DeCandolle in his Prodromus, only 5 are East Indian, 5 from Equinoctial Africa, 1 from the Cape and 1 from Arabia. Since that time considerable additions have been made to the Indian list, as there are about 20 enumerated in Wallich's list, and Blume has 6 from Java. To the Peninsular list nothing has been added since the publication of our Prodromus, except that the genus *Ancistrocladus* is ascertained to be unquestionably a native, as I have found it abundantly in the woods of Courtallum, and have also received specimens from Bombay: also from Maulmain and Ceylon. This therefore seems a widely diffused genus, but I have great doubts of the propriety of referring it to this order. The species of *Malpighia* here figured flowered in the garden of the Madras Horticultural Society, and is I believe of Chinese origin, if so, it is the first of the genus which has been found in the old world, but I doubt whether it can be admitted as a legitimate member of the genus.

PROPERTIES AND USES. Under this head little is known, and respecting the Asiatic members of the order nothing, except that they are highly ornamental twining shrubs, and merit a place in every shrubbery having ornament for its object, though so far as I have seen, they are nearly unknown in Madras.

REMARKS ON GENERA AND SPECIES. The genera of this order amounting, according to Meisner, to 26 in number, are distributed into three tribes, *Malpighieae, Hiptageae,* and *Banisterieae,* of the two last of these only, the Indian flora can with certainly be said to possess representatives. The native country of the *Malpighia* I have represented is uncertain. We no doubt received it from China, but have no means of ascertaining whether it is really a Chinese plant. *Ancistrocladus* is also referred to this tribe, but there is much reason to doubt whether

it belongs to the order. *Platynema* and *Hiptage*, both certainly Indian plants, belong to the 2d tribe, and *Hiraea* equally so to the third. As these three are all old and well known genera, it is unnecessary further to notice them here. *Malpighia* is also well known but not in this quarter, on which account I have been induced to give a figure illustrative of the tribe, if not of the genus; for in truth I rather think this plant will be found to constitute the type of a new genus, when examined by Botanists conversant with the tribe, which I am not, and therefore abstain from giving what may prove a needless generic name. It differs from *Malpighia* in its unequal filaments and anthers, as well as in its very unequal styles, but associates in the characters of its sepals, petals, and fruit; on which account I refer it to that genus. The peculiarities of the stamens and styles sufficiently distinguish the species.

Ancistrocladus, as already remarked, is an extensively distributed genus, and when the species referred here, rather from similarity of habit than Botanical scrutiny, have been carefully examined, will probably be found to embrace more than one genus, and form the type of a new order intermediate between *Dipterocarpeæ* and *Malpighiaceae*, but removed from both by the subinferior 1-celled ovary, with a solitary erect ovule. Vahl describes the species he saw (from Ceylon) as pentandrous. The Courtallum one has 10 stamens, one I have from Mergui, has 10 stamens, but united at the base by pairs like those of *Hopea*. This last associates in habit and in the form of its flowers, but differs in the ovary, which seems rudimentary. In all I have seen in fruit the sepals enlarge and become wing-like as in the *Dipterocarpeae*, not the carpels themselves as in some *Malpighiaceae*. Whether these different forms will ultimately be considered to form types of so many genera, and the whole a new order, future experience must determine, but in the mean time I do not think it can with propriety be referred to this order without much violence to existing affinities.

With *Dipterocarpeae* it is associated on the one hand, by the wing-like expansion of its sepals, when in fruit, by a more or less perfect union of its petals and filaments towards the base, by its twisted æstivation, and finally by its exalbuminous seed and thick fleshy exceedingly crumpled cotyledons: while on the other, it is removed by the ovary being inferior, not superior; one, not 3-celled, and with one erect, not several, pendulous ovules; and finally, by its scandent habit. The erect solitary ovule and scandent habit are the only points by which it approaches *Malpighiaceae*, while it is removed by the insertion of the petals being perigynous, by their being exunguiculate and occasionally cohering at the base, by their æstivation being twisted, not imbricative, and lastly, by the crumpled cotyledons. Much examination however is still required for the satisfactory elucidation of this very curious genus, but enough has been ascertained to shew that it is more nearly allied to *Dipterocarpeae* than to *Malpighiaceae*.

MALPIGHIA.

M. heteranthera, (R. W.) Shrubby, ramous, leaves roundish, armed with spiny teeth, glabrous: peduncles axillary, jointed, furnished with two bracteal scales: petals unequal, fimbriated on the margin: stamens monadelphous at the base, two of them much larger: styles three, all distinct, two larger much bent, the other straightish and smaller: fruit composed of three unequal sized drupes.

Hab.—Uncertain, but supposed to have been brought to Madras from China.

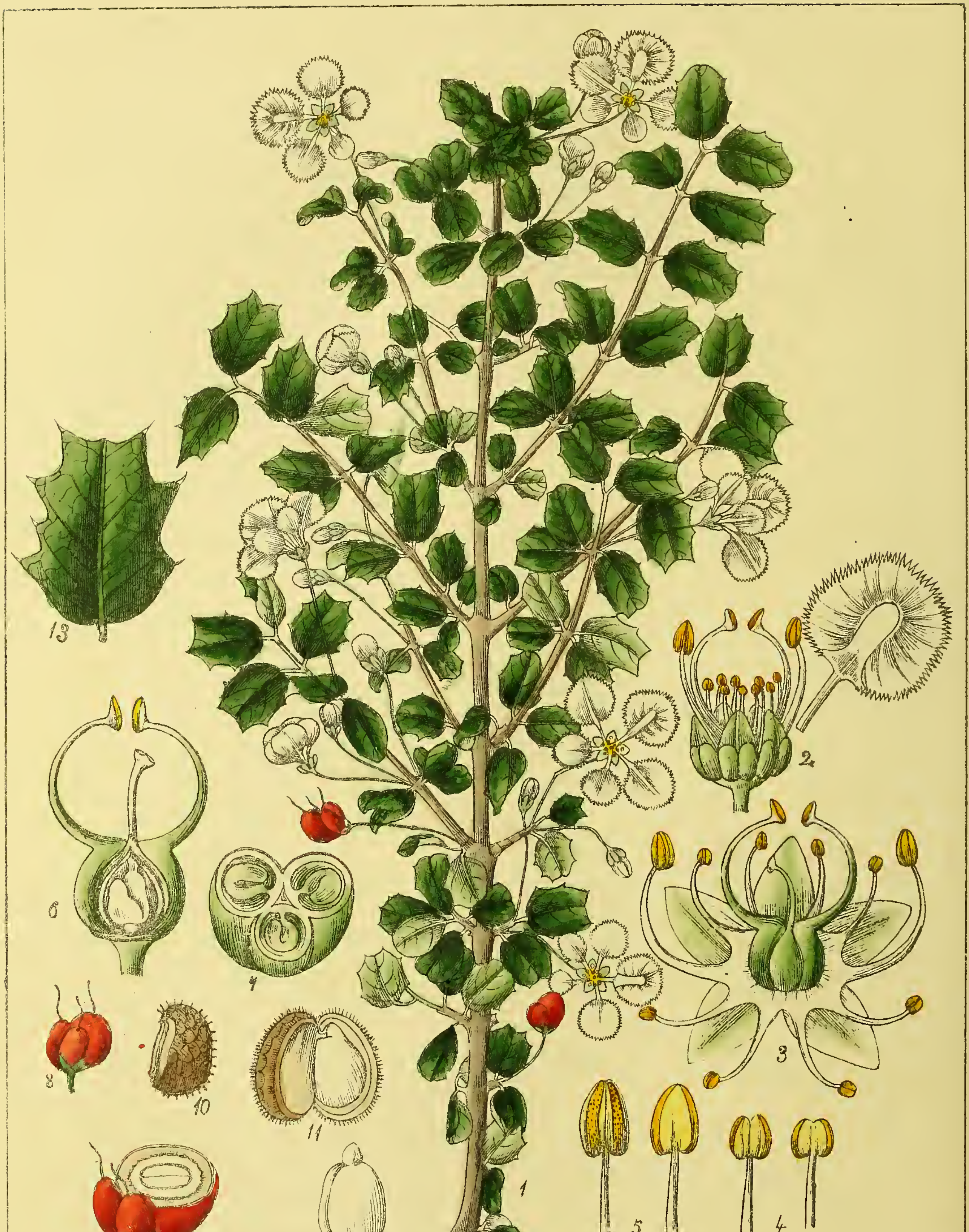
This, as it appears in the Horticultural garden growing in a flower pot, is a small, very ramous, erect, leafy shrub, the leaves armed with sharp spiny teeth, like the *Holly*. The petals are plaited, unequal sized, fimbriated on the margin, usually pure white, but occasionally with a light rosy tinge. The fruit rarely arrives at maturity, but when it does seems to consist of three berries, scarcely adherent except at the base, one usually much larger than the other two, and that the one which bore the smallest style.

HIRÆA.

The two species of this genus established by Roxburgh and adopted in our Prodromus, unless distinguishable by the fruit alone, seem either but varieties of the same plant, or the one we had before us as *H. indica* is incorrectly described, as having the leaves glabrous on both sides. This I have ascertained through a number of newly preserved specimens recently received, the under surface of the leaves of which are covered with a soft downy pubescence. The same I observe must have been the case with my original specimens when first collected, as there are still some remains of it visible. These two species, it would appear from this, can only be distinguished by the form of the wings of the carpels, that is whether they are oblong or elliptic. This may be a good specific character, but not the clothing. I have specimens of a third species, from Mergui, with carpels nearly answering to Roxburgh's description of *H. nutans*, though not exactly, as they are orbicular in place of elliptic; the leaves are nearly oval, acute at both ends, and glabrous, which marks, when added to the diffuse few flowered panicles form a combination of characters which leaves no doubt of this one being distinct from all the Indian forms. These three species then may be thus distinguished by their fruit.

H. indica, carpels each surrounded with an oblong-linear entire wing.

H. nutans, carpels " surrounded with a large entire reticulate scarious elliptical wing." (Roxb.)



MALPIGIA? HETERANTHERA. (R. W.)

Utimookta San HIPTAGE MADABLOTA (GART.) Malutee Beng.

H. Merguienses, carpels surrounded with an orbicular thin transparent scarious rcticulated wing.

In the two first the panicles are described as large, compound and clothed with appressed hairs, in the last they are diffuse, glabrous, with few flowers, on long very slender jointed pedicels.

H. cordata, appears quite distinct from all these, but the fruit is as yet unknown.

The fruit of our *H. indica* is also unknown, and as it differs from Roxburgh's plant in having the under surface of the leaves rather thickly clothed with soft appressed pubescence, not glabrous, it may, when the fruit is found prove either Roxburgh's *H. nutans,* or a distinct species, but for the present must remain undetermined.

EXPLANATION OF PLATE 49.

1. Malpighia ? heteranthera, (R. W.) *natural sise.*
2. A partially dissected flower showing the glands of the sepals, a petal with its claw, and the unequal stamens and styles.
3. The same forcibly opened to show the union of the filaments, and more clearly the ovary, styles and stigmas.
4. Back and front views of a small anther.
5. The same of a large one.
6. The ovary 1-cell opened, to show the pendulous incurved solitary ovule.
7. The ovary cut transversely near the apex.
8. A mature fruit, *natural size.*
9. The same, one of the carpels cut transversely.
10. A seed removed and freed from its pulp, to show the rough reticulated testa.
11. The same opened to show the position of the seed.
12. Foliaceous cotyledons and the radicle.
13. A leaf—*all, with the exceptions mentioned, more or less magnified.*

EXPLANATION OF PLATE 50.

1. Hiptage Madablota, (Gært.) *natural size.*
2. An expanded flower, the petals removed to show the relative position of the other parts.
3. The petals.
4. Anthers back and front views.
5. Ovary, style and stigma.
6. Style and stigma detached, and more highly magnified.
7. Ovary cut vertically.
8. Cut transversely, 3-celled.
9. A full grown fruit, *natural size.*
10. Cut transversely—*with the exceptions mentioned, all more or less magnified.*

XXXVII.—SAPINDACEÆ.

This is a large and complex order presenting among its members slender climbing herbs, small shrubs, and large umbrageous trees. The leaves are alternate, simple, or compound; in the latter case, either ternate, or biternate, more frequently abruptly pinnate. The flowers equally vary, being either uni or bi-sexual, or frequently presenting both forms on the same tree, polygamous. The inflorescence is either racemose or panicled, the flowers usually small, sometimes nearly inconspicuous, generally white, or pale greenish white, more rarely purplish coloured.

Calyx free of 4-5 distinct or slightly cohering sepals, imbricated in æstivation. Petals usually as many as the sepals, alternating with them, sometimes fewer by the abortion of one, or altogether wanting, either naked, hairy, glandular, or furnished with a petaloid scale within, and also imbricated in æstivation. Torus usually a hypogynous disk, occupying the bottom of the calyx, expanded between the petals and stamens. Stamens 8-10 in a single series, inserted on the disk or receptacle between the glands and ovary; filaments free, anthers incumbent, 2-celled, bursting longitudinally, introrse, when polygamous, the pistil of the male flower is either rudimentary, or wanting. In the female the ovary is usually 3, rarely 2, or 4-celled, usually with a single erect or ascending ovule in each, rarely with two superposed ovules, and then one is ascending, the other pendulous; sometimes they are numerous. Style undivided or 3-cleft, more rarely, bifid. Fruit fleshy and indehiscent, or vesicular, or capsular, and 2-3 valved, some of the cells occasionally abortive. Seeds usually arillate, albumen none. Embryo usually curved, or spirally convolute, rarely straight; radicle pointing towards the hilum. Cotyledons sometimes conferruminate.

Affinities. The relationship of this with the three preceding orders will be evident from a reference to the Conspectus, page 137, where it is introduced as a member of the class *Malpighinæ,* other affinities are indicated by Botanical writers, but as these appear somewhat remote I shall not myself attempt to detail them, but rather extract from Dr. Lindley's Natural System of Botany the paragraph in which they are explained.

" From *Aceraceæ* these scarcely differ, except in their alternate leaves and petals, which have almost always an appendage on their surface. In some respects near *Meliaceæ*, which agree in habit and in their pinnated leaves, but which are known by their monadelphous stamens and symmetrical flowers. To *Polygalaceæ* they are no doubt akin in the singular combination of 8 stamens with 5 unequal sepals, and an uncertain number of petals; and also in their aril, which may be compared to the caruncula of *Polygalaceæ*, although somewhat different in its origin. The dried leaves resemble, as DeCandolle remarks, those of *Connaraceæ*. Their climbing habit and tendency to produce tendrils indicate a relation to *Vitaceæ*, which, however, is not very near. Brown remarks, that although in the far greater part of this family the ovule is erect, and the radicle of the embryo inferior, yet it includes more than one genus, in which both the seeds and embryo are inverted."

To me it is matter of surprise that there is no allusion in any work I have had an opportunity of consulting to any affinity existing between this order and *Euphorbiaceae*, though some of the genera of each order seem so closely allied that it is difficult to say to which order they ought to be referred.

Geographical Distribution. This large order is nearly confined to the tropics, or extends but a short way beyond, being still limited to the warmer latitudes on either side. The greater number of species are natives of Equinoctial America, and India; Africa also has many of them, but they are unknown as natives in Europe and the United States of America, while the genus *Dodonæa* alone represents them in New Holland. We have not the same data for estimating the number of Indian species as in most of the other orders yet gone through, as they are not included in Wallich's list of Indian plants. The number of Peninsular ones known to us amounted however to only 14, and these have not since been augmented. This I should suppose falls greatly short of the actual number as Blume in his Bijdr: Floræ Javæ, has no fewer than 23 species, and in Ceylon there are several that have not yet been met with on the continent, though it seems to me they are such as might be expected. Those met with on the continent occupy very different stations. Thus *Cardiospermum Halicacabum* is commonly met with in hedges and corn fields, while *C. canescens* is rarely met with except in dry jungles, where it appears as a very extensive climber, and when in full flower, which it is the greater part of the year, is really a pretty plant. The *Sapindus emarginatus* is generally met with as a cultivated plant, but is not rare in subalpine jungles in a wild state. The same remark applies to *Schleichera trijuga*. *Nephelium Longanum* on the other hand, a species very closely associated with *Litchi*, I have only seen in jungles, and usually at a considerable elevation. The *Schmidelias* which are shrubby very ramous plants, sometimes becoming small trees, and bear a small red berry, are always so far as I have seen, jungle plants. Our only species of *Cupania, C. canescens*, is never I believe met with in cultivation, but is a common plant in subalpine jungles and has a wide distribution over India.

Properties and Uses. This family is remarkable on account of the leaves and bark, and even the fruit of some of its species being possessed of active medicinal or even decidedly poisonous properties, while the fruit of others, is highly esteemed for the dessert. Among these last are the *Litchi*, the *Rambutan*, the *Longan*, and a variety of others. The root of *Cardiospermum Halicacabum* is aperient. The succulent capsule of *Sapendus emarginatus*, the common Soapnut, is considered by the native practitioners an excellent expectorant, an opinion which Dr. Ainslie thinks correct, it is also, as the English name implies, a useful detergent, and much used as such. The root *Schmidelia serrata* (Ornithrophe Roxb.) is according to Roxburgh a mild astringent, and prescribed by the natives in cases of diarrhæa, while the small red subacid berries are eaten by the natives. So also is the subacid aril of the seed of *Schleichera trijuga*, a large and handsome tree, not uncommon in our jungles; and from the seed themselves a lamp oil is expressed in Malabar.

Remarks on Genera and Species. The discrimination of the genera of this order is often most difficult, unless the specimens under examination are very complete. When furnished with both flowers and fruit the characters are more easily made out, but without fruit the reverse is often the case, as for example, between some of the species of *Cupania* and *Sapindus*. With these exceptions the *Sapindaceæ* of the Indian Peninsula are for the most

Rungia del.

SAPINDUS EMARGINATUS.

Winchester - Lith

Poovandie-cottay-marum-Tam
Burra reetha-B.
Ritah ——— H.

Kunkoodoo-chettoo-Tel.
Rishta ——— S
Gas-penela-Cyng.

part easily distinguished—*Cardrospermum* has bladdery 3-celled capsules and climbs by tendrils. *Schmidelia* has soft pulpy berries, 3 foliolate leaves, and a shrubby ramous habit. *Nephelium* at least the Peninsular species is known at first sight by its rough tuberculated fruit, which is usually only 1-celled. *Schleichera* by the want of petals and by its globose 1-seeded fruit being pointed with the persistent base of the style, and not unfrequently armed all over with projecting prickles. *Sapindus* is distinguished by its lobed fruit, each lobe 1-seeded, the seed not furnished with an arillus, while in *Cupania* the fruit is 3 angular 3-celled, each cell with a single seed furnished with an arillus. When in flower only it is difficult to distinguish the two last. *Dodonæa* is at once known from all its Indian allies by its winged carpels.

With respect to species I have but little to add, except that in many instances they are apt to vary exceedingly and become of difficult determination, hence in some genera, there is reason to believe, they have been unnecessarily multiplied. No new Peninsular ones have been added to my collection with the exception of *Sapindus laurifolius*, of which I have now Peninsular specimens. Our *Sapindus deficiens*, of the genus of which owing to our specimens wanting fruit, we were doubtful, I have now ascertained to be really a *Sapindus*, and also that it is a native of Ceylon as well as of the continent. It appears very nearly allied to *S. rubiginosus*, like it two of its cells often aborting from an early stage. It is truly a superb species, its racemes sometimes attaining nearly two feet in length, and the leaflets of the leaves from 12 to 15 inches. The flowers are, so far as I have seen, the largest of the genus. These more perfect specimens have shown that a correction in the character of this species is required, the petals in place of being "oblong attenuated into the unquis woolly at the back and lower half of the margin" I find to be nearly orbicular and glabrous. In all other respects our character agrees well with the specimens. *Sapindus squamosus* Roxb. seems to exist in Ceylon, I have a specimen from that country so nearly answering to his description as scarcely in my mind to leave a doubt of its being that plant. *S. microcarpus* (W. and A.) I have now ascertained does not belong to the genus, but is a *Millingtonia* which I have figured under the name of *M. Arnottiana*. Ceylon presents an undescribed species of *Nephelium*, named by Mr. Moon in his catalogue *Democarpus pupilla*, (*N. pupillum*) the fruit of which is oblong ovate, attenuated towards the apex and perfectly smooth, without warts or tubercles, in other respects it is so nearly allied to *N. Longanum* that actual comparison is required for their discrimination, when some slight differences become obvious, but not sufficient to distinguish them by written characters. Of *Schleichera* I have now specimens with smooth unarmed fruit, but which, so far as I can perceive, do not otherwise differ from *S. trijuga*, on which account I am disposed to consider the two forms varieties only.

The species of *Schmidelia* are all so nearly allied and so variable in their forms that I can scarcely help thinking that there are not more than a very few appertaining to the genus, though Roxburgh describes 7 Indian ones, including *Aporetica pinnata* of authors, but excluding *S. Allophyllus*, a Ceylon plant, which DeCandolle includes—DeCandolle, exclusive of *Aporetica* which he retains as a distinct genus, has 18 species, but I fear not all good. The two described in the Peninsular Flora, are perhaps, nothing more than varieties. The only mark by which I have been able to distinguish them is to be found in the inflorescence, being in *S. serrata* a simple undivided spicate raceme, while in *S. Cobbe* it is branched, but this is not a good distinction, since I have seen unbranched spikes mixed on the same plant with branched ones.

The species of *Dodonæa* like those of *Schmidelia* are difficult to discriminate, and have I suspect been needlessly multiplied, owing to imperfection of materials; mere variations, of specimens having in many instances been elevated to the rank of species. In India I have certainly never seen more than one species, though I have them from all quarters—and from every grade of ascent from the level of the sea to an elevation of 7000 feet on the Pulney mountains, where the plant figured in plate 52 was obtained. Among the specimens collected there, variations occur sufficient, if procured under other circumstances, to form two or three species, but which are certainly all referable to one.

EXPLANATION OF PLATE 51.

1. Sapendus emarginatus, *natural size.*
2. A full grown flower.
3. The same, the sepals thrown back to show the insertion of the petals.
4. Sepals and petals removed, to show the insertion of the stamens in a bisexual flower.
5. Stamens back and front views.
6. A female flower dissected.

7. The ovary cut transversely, 3-celled.
8. The same cut vertically, ovules erect.
9. A small but mature fruit, *natural size.*
10. The same cut transversely.
11. A portion of a leaf magnified to show the pubescence—*with the exceptions mentioned, all more or less magnified.*

EXPLANATION OF PLATE 52.

1. Dodonæa Burmanniana, (D. C.) *natural size.*
2. A bisexual flower, but with the male organization highly developed.
3. Stamens removed to show the ovary.
4. The ovary cut transversely.
5. The same cut vertically, showing in this instance solitary ovules.
6. A bisexual flower, the female organization predominating.
7. Stamens.
8. The ovary cut transversely.
9. Cut vertically, showing the ovules double and superposed, the one ascending the descending.
10. Detached ovules, showing their large curunculoid funeculus.
11. A different view of the same.
12. A mature fruit showing its winged carpels, *natural size.*
13. The same cut transversely, *natural size.*
14. A mature seed—*with the exceptions mentioned, all more or less magnified.*

XXXVIII.—MILLINGTONIACEÆ.

This is a small Indian order limited as yet to a single genus of arborious plants, distinguished by their alternate exstipulate leaves, which are either simple or pinnate, and in the latter case are rendered still more remarkable by their being either abruptly or unequally pinnated. The inflorescence is panicled, the panicles being either terminal or axillary near the summits of the branches. The flowers are small sometimes almost inconspicuous, nearly sessile, on short lateral peduncles of a pale greenish yellow and very numerous.

Sepals 5, persistent, unequal, somewhat in a double series: æstivation imbricative. Petals 5, inserted on the margin of the receptacle, deciduous, alternating with the sepals of two kinds; three outer ones orbicular, entire, with an imbricative æstivation; two interior smaller, acutely bifid, resembling scales. Stamens 5, opposite to the petals, and slightly united to them at the very base; three exterior sterile, opposite to the larger petals; two interior fertile, opposite to the bifid petals; filaments of the fertile stamens flat: anther, cells globose, dehiscing transversely, placed side by side on the inner side of the saucer-shaped connectivum. Disk, flat, thin, hypogynous, free, except at its point of attachment with the ovary and receptacle. Ovary ovate, 2-celled; ovules 2 in each cell, superposed. Style simple, short, and thick. Stigma slightly 2 lobed. Fruit a 1-celled, 1-seeded drupe; the dissepiment evanescent above, hardened and persistent at the base. Seed with a small cavity on one side, near the base. Albumen none or extremely thin. Embryo curved: cotyledons thin, foliaceous, folded: radicle curved, pointing to the hilum. Trees. Leaves alternate, without stipules, entire, or rarely pinnated. Inflorescence in panicles, terminal, or axillary near the extremity of the branches. Flowers small, inconspicuous, nearly sessile, on very short peduncles that are arranged along the horizontal branches of the panicles. (W. and A. Prod.)

Affinities. The affinities of this order are viewed in very different lights by different authors. Mr. Arnott and myself aided by a suggestion of Dr. Hooker placed it between *Sapindaceæ* and *Meliaceæ.* Dr. Lindley looks upon the order as forming but a section or suborder of *Sapindaceæ,* while Meisner for reasons which do not appear refers it to *Berberedeæ,* a distribution in which I cannot coincide. In confirmation of Dr. Lindley's view it may be stated that my *Millingtonia Arnottiana* is actually the plant we have described as *Sapindus microcarpus,* which may be considered a convincing proof of the close relationship existing between them, if not a satisfactory indication that we were premature in separating this genus as the type of a distinct order. However, bringing analogy to bear on the question, we have already seen *Hippocratiaceæ* established on its unsymmetrical flowers, and *Erythroxyleæ* separated from *Malpighiaceæ* on account of the appendages of its petals. hence, if such reasons are applicable to one set of instances they ought to be equally so to another, and as the differences of the arrangement of the flowers between *Sapindaceae* and *Millingtoneaceae* are certainly equal in amount to those of the other, it must be admitted that if they are to be adopted in the one set they ought equally to be so in the other. In urging this view I do not advocate its adoption, but think with Lindley that the sooner we can retrace a false step the better, and

Varawly Jam

DADONÆA BURMANNIANA. (D.C.)

Kundaree-chettoo

therefore hope our error should it prove one will be speedily corrected, and at the same time the other to which I have alluded. That the circumstances which induced us to constitute this genus the type of a distinct order may be fairly stated, I shall reprint here, from Jameson's Philosophical Journal, our introductory observations, and also Lindley's remarks explanatory of his views.

"The simple generic character of *Millingtonia* given by Roxburgh, in his Flora Ind. vol. i. p. 102., although sufficiently exact for the Linnean classification, in which those parts only are accounted stamens that have pollen, conveys little information as to the real structure of parts. The nectarial bodies opposite the petals, are of a very singular shape. The apex (which Roxburgh erroneously represents free) is incurved, and attached in front, similar to the petals of some umbelliferous plants, leaving two large hollows, one on each side, as if for the reception of the cells of an anther. Indeed, their whole appearance is that of abortive stamens, in which light we feel disposed to view them. The bifid scales, at the back of the fertile stamens, are of a very different texture, and these, we believe, are abortive petals. Thus, we have both stamens and petals heteromorphous; the imperfect forms of the one set of organs opposite to the perfect ones of the other. The calyx we have always found to consist of two interior sepals, and three exterior, one of which, and sometimes, but rarely all, are similar in size to the interior, and alternating with them: there are in some species in addition, small close-pressed bracteolæ. The mode in which the calyx is placed is well figured by De Candolle (Organ. Veg. t. 37. f. 12. *p.*) We have, then, a calyx, a corolla, and andrœcium, each of five parts, placed apparently in a double series; the one dissimilar to the other, and alternate with it; thus analogically shewing, that the hypogynous disk must be viewed as an outer series of the gymnœcium, the bidentate angles alternating with the two cells of the ovary. At first, also, it would appear that the two outer parts of each organ alternate with the inner of the next, but this is only in appearance; for, if that were the case, the angles of the hypogynous scale would be opposite to the three larger petals, whereas they alternate with them. The real disposition of parts, therefore, will be better understood, if we suppose each organ to be of only one series, and of five parts; the petals alternating with the calyx, the stamens opposite to the petals, and the pistilla alternating with both stamens and petals. That this is the true explanation, is confirmed by the fact, that, in no known plant, where any organ consists of a double series of parts, do the component parts of one series differ in number from those of the other. The æstivation will thus be imbricate and quincuncial; and in such, two or three (as may happen) parts of the same organ are interior. It is, however, remarkable to find them of so very different a structure as occurs in this genus.

The Affinities of *Millingtonia* have not, so far as we know, been pointed out. The habit is much that of *Semecarpus*, *Mangifera*, and *Buchanania*, and, like the *Terebinthaceae*, the embryo is campulitropal. The genus *Sabia*, also, has the stamens opposite the petals, the ovarium bilocular, two ovules in each cell, the one placed above the other; but the petals are likewise opposite to the sepals, and the habit is different: moreover, it is by no means certain that *Sabia* ought to be referred to the *Terebinthaceae;* and the characters of all the other genera of the order present little in common with *Millingtonia*. Our friend Dr. Hooker has suggested an affinity with *Sapindaceae;* and with different genera of that order, it has several points in common,—as the fleshy disk, the two superposed ovules in each cell, the indehiscent fruit, with part of it abortive; the absence of albumen, and the curved embryo; but that order has usually stamens twice as numerous as the petals, and, in addition, scales or tufts of hair at the base of the petals; so that if, as in *Millingtonia*, these scales were to be viewed as abortive stamens, the whole number of stamens would much exceed that of the petals. In *Sapindaceae*, too, the hypogynous disk is fleshy, and is, we believe, the torus: here it is quite free from the receptacle, except at the point of attachment, and appears to be formed by the union of an outer series of styles. Although, therefore, we cannot agree to place it among the true *Sapindaceae*, we can see but little objection to its forming the type of a new order next them."

The following remarks on the Affinities of this order are extracted from Dr. Lindley's Natural System of Botany. "The plants belonging to this assemblage are looked upon by Wight and Arnott as forming a family distinct from, but closely related to, *Sapindaceae*. The principal differences pointed out by those authors are. that in the latter the stamens are usually twice as numerous as the petals, which have scales or tufts of hair at their base; and the hypogynous disk is fleshy. Other points are, indeed, adverted to, but they are either unimportant. or not clearly explained. These authors do not take the same view of the structure of the genus as Roxburgh,

but agree with Jack in considering the number of petals 5, of which three only are petaloid, and the other two bifid and adnate to the base of the two fertile stamens. It appears to me, however, that in reality, in *M. simplicifolia* at least, there is very great irregularity in the proportion of the parts of the flower; in the calyx I find six pieces, two very minute and external, two larger, but unequal, next the first, and two more, also unequal, in the inside; petals I see only 3, on the face of the largest of which is a distinct trace of a rudimentary scale; the stamens are 5, three of them being deformed, lobed, and opposite to the three petals, the other two fertile, alternating with two of the petals, with a membranous tooth on each side at the base (not the apex, as Roxburgh has it), and a remarkable saucer-like connective, on the upper face of which grow two anther-cells, the valves of which are extremely unequal. I do not, therefore, perceive how the genus differs from *Sapindaceae*, except in the pistil being composed of two carpels instead of three. But although the number three is what usually prevails in *Sapindaceae*, yet there are instances of two in *Schmidelia*, *Irina*, &c. and of four in *Talisia* and *Dodonaea*."

Geographical Distribution. The genus *Millingtonia* has a wide range though as yet limited to few species. Roxburgh received his specimens from Silhet, of the only two species he knew, since then, I have received specimens from various parts of the Peninsula, Ceylon and Maulmain. Dr. Wallich has also found two, distinct from Roxburgh's, one of which, *M. pungens*, is found in the Peninsula, *M. Arnottiana* is a native of the more elevated regions of both Ceylon and the Peninsula, my continental specimens are from the Neilgherries The leaves in this species are unequally pinnated, which at once distinguishes it from Roxburgh's *M. pinnata*, which has abruptly pinnated leaves.

Properties and Uses. Nothing is known on this head except that the timber of some of the species is used for various purposes by the natives of the districts where they grow.

Remarks on Genera and Species. Of this order only one genus is yet known, that from which it takes its name. Of the species now 5 in number, Roxburgh knew only two, *M. simplicifolia* and *M. pinnata*, to these Dr. Wallich has added *M. dilleniifolia* and *M. pungens*, the last *M. Arnottiana* is now for the first time published under that generic name, and is a native of both the Peninsula and of Ceylon. The characters of two species are already published in our Prodromus, those of the remaining three I shall introduce here with the view of making them better known to Indian Botanists.

MILLINGTONIA.

M. dilleniifolia, (Wall.) Leaves simple, elliptic, oblong, attenuated at the base, pubescent beneath; the secondary nerves parallel, straight, extending beyond the margin in prickle-like teeth, panicles slender, lax, pubescent; rachis angled; flowers somewhat remote on the extreme branches, calyx ebractiate, sepals 5, nearly equal, ciliate on the margin, exterior petals roundish, concave, the interior ones cleft nearly to the base, or half shorter than the petals.

M. pinnata, (Roxb.) Leaves abruptly pinnate, pinnæ 6-12 pairs; leaflets elliptico-lanceolate, glabrous on both sides, denticulate, serrated, the teeth incurved, with the secondary nerves incurved within the margin, confluent; panicles lax, puberulous, rachis angled, sepals unequal, two of them bracteiform; the exterior petals roundish, the interior ones cleft to near the middle equalling the petals.

M. Arnottiana. Leaves unequally pinnate, pinnæ 5-7 pairs; leaflets ovate, acuminate, coriaceous, glabrous above, pubescent beneath, quite entire, panicles axillary, large lax and like the petiols of the leaves thickly clothed with short rusty coloured hairs, rachis terate, sepals somewhat unequal, exterior petals roundish, pointed, interior ones cleft nearly half their length, the points reflexed, filaments furnished with two scales below the middle.

Sapendus microcarpus, W. and A. Prod. I. p. 112.

Hab.—*Neilgherries and Ceylon.*

EXPLANATION OF PLATE 53.

1. Flowering branch of Millingtonia Arnottiana—*natural size.*
2. A flower partially open.
3. The same dissected.
4. The same, the petals removed, showing the stamens, ovary, &c. *in situ.*
5. Back and front views of the stamens and anthers.
6. A diagram of the flower.
7. The ovary cut vertically, showing the ovules superpossd.
8. The same cut transversely.

MILLINGTONIA ARNOTTIANA.

XXXIX.—MELIACEÆ.

This order is found generally distributed over the tropical parts of the globe, but of rare occurrence beyond the 40th degree of latitude. It consists principally of trees and shrubs, rarely of herbaceous plants, with alternate, rarely opposite, petioled, simple or compound, impunctate leaves, with or without stipules, and bisexual flowers, apparently disposed in racemes, corymbs, or panicles, but when more carefully examined found to consist of a regular series of dichotomies. The primary divisions for example are alternate, but each of the subdivisions soon become opposite, with a præcocious subsessile flower in the fork. In this manner the terminal ramifications present the flowers in groops of three together, the middle one nearly sessile, and the lateral ones peduncled; the central flower opening before the side ones, hence, the inflorescence proceeds from the centre to the circumference, (*centrifugal*) and not from the circumference to centre (*centrepetal*) thus constituting true cymes, the reunion of which imitates, but does not constitute true panicles. This centrifugal inflorescence can be more or less distinctly traced through the whole order, for even in those cases where reduced to a solitary flower, still the peduncle is furnished with several bracts showing the compound tendency. This arrangement of the inflorescence, the researches of M. Adrian de Jussieu have shewn to be an important character. The following character of the order is taken from Jussieu's memoir.

Calyx 3-4-5 cleft. Petals the same number, longer, free, or more or less intimately united at the base to each other or to the staminal tube. Stamens double the number, the filaments united into a tube, with the anthers opening inwards, inserted on a hypogynous disk, filaments flat, bidentate at the apex, with the anther attached in the middle between the teeth, disk various in form. Style and stigma simple, stigma capitate, or pyramidal, lobed or angled, according to the number of cells in the ovary. Ovary single, with as many cells as there are petals, sometimes fewer, (3-2) rarely multiples, (10-20) with 2, rarely 1 or 4 ovules. Fruit various, fleshy, baccate or drupacious, indehiscent, or capsular, with valvate dehiscence, the cells usually 1-seeded by abortion. Seed with or without an arillus, never winged or flat, albumen fleshy, (Melieæ) or oftener wanting (*Trichilieæ*) in the former, cotyledons foliaceous, with the radicle exserted, in the latter thick or conferuminated, with the radicle short and retracted between them.

Affinities. The most nearly related order is *Cedrelaceæ*, with which, this was united until separated by Adr. de Jussieu for reasons which cannot but be considered satisfactory in the present state of the science, though still such as to render their proximity in the series quite indispensable as they have many characters in common, they differ principally in the polyspermous fruit and compressed winged seed of *Cedrelaceae*, to which may be added, the axillary inflorescence of the one and the terminal of the other. The affinity existing between *Meliaceæ* and *Aurantiaceæ*, is shown by the dichotomous inflorescence common to both, and in the union of the filaments observed in a few genera of *Aurantiaceæ*. Some more remote affinities are observed between this order and *Guttiferæ*. The *Rutaceæ* are distinctly allied by their staminal arrangement, the stamens in some being inserted into large bifid scales, which form an independent verticel, and still more by the two ovules in the cells of the ovary, exclusive of some minor points, but which taken together form a considerable analogy between the two. With *Sapindaceæ* a close affinity exists in the structure of the flowers and general habit of the plants, while the structure of the seed is absolutely the same. Some remote affinities can also be traced between this and *Terebinthaceæ*.

Geographical Distribution. This is mainly a tropical order, only two or three species extending so far as 40° on either side of the line, but becoming more abundant as we approach that centre. In America and Asia, the number of species are nearly equal, and so far as is yet known about four times as many as has yet been observed in Africa, this may be owing to the flora of the latter continent being less perfectly known than either of the other two. The whole number known to M. Jussieu when he published his memoir was 125, but several additions have since been made, so that the order may now contain probably about 150 known species. Dr. Wallich enumerates in his list about 50 species, but some of the supposed new ones I have ascertained not to be distinct from previously named species. Blume has 35 spe-

cies from Java alone, showing how much they augment near the equator. The Peninsular flora when we wrote only presented a list of 13 species, a few have since been added.

Properties and Uses. These are of a high order and very varied character: here we find some pleasant fruits, valuable medicines, and useful timber. The fruit of *Sandoricum*, of some species of *Lansium* and of *Milnea edulis*, are eatable, having a watery cooling pleasant pulp; but generally, bitter, astringent, tonic qualities are the properties of this order. Some species however, are of a very different description, the juice of the bark being purgative and violently emetic. The bark of the Margosa or Neem tree (*Azadirachta indica*) has been beneficially employed in this country as a substitute for Peruvian bark. The leaves are every where esteemed, on account of their sanitary qualities, real or supposed, as an external application in all kinds of superficial ailments, whether the result of violence, as a bruise, cutaneous eruptions, or rheumatic pain. On the decline of small-pox it is almost invariably the practice, among the natives of this part of India, to cover the body with these leaves. From the fruit a very bitter oil is expressed. This like the olive oil is procured from the pulp of the fruit, not the kernel of the seed, and combines the bitter tonic properties of the plant, hence it is esteemed a useful anthelmintic, and is considered an excellent external application in rheumatic cases, and in some cutaneous diseases.

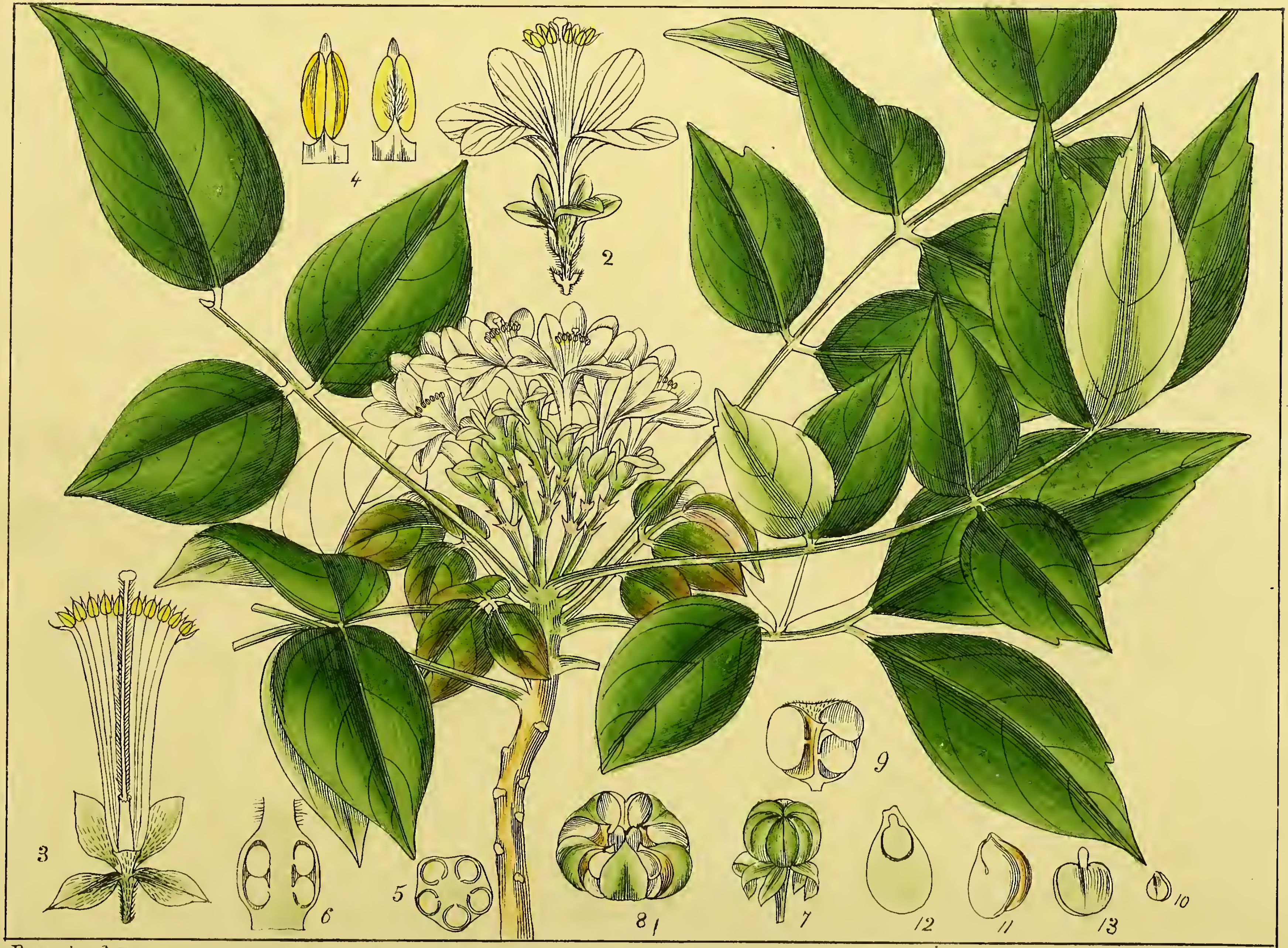
In the arts, the timber of the Neem tree, which is hard and durable, is found fit for ship-building, and that of some species of *Melia*, which attain a large size, there is reason to believe is equally valuable, though on this point my information is imperfect.

Remarks on Genera and Species. The genera of this order, which are very numerous in proportion to the number of species, are ranged under two tribes *Melieæ* and *Trichilieæ*. The former is distinguished by having the embryo enclosed within a thin fleshy albumen, foliaceous cotyledons, and the radicle protruded. To this division *Naregamia*, *Munronia*, *Melia*, *Azadirachta* and *Malea* of the Peninsular flora belong. To the latter, distinguished by having exalbuminous seed, thick cotyledons, a short radicle, commonly concealed between the cotyledons, and alternate simply pinnated leaves, with entire leaflets: *Milnea*, *Amoora*, *Walsura*, *Sandoricum*, *Heynea* and *Xylocarpus* are referable. With one exception (*Munronia*) all these are old established genera, and do not require further notice. *Munronia* first established in this work, has only three known species, one from Silhet, *M. Wallichii*, (*Turræa pinnata*, Wall.) one from Ceylon, *M. pumila*, R. W. Icones Pl. Ind. Or. No. 91, (*Melia pumila*, Moon) and *M. Neilgherica*, from the Neilgherries and Coorg.

In habit this genus nearly resembles our genus *Naregamia*, so much so indeed, that I at first supposed *M. pumila* a new species of that genus, and it was not until after very careful examination and comparison that I ascertained they were distinct: the principal distinguishing marks are the petals being united to the base of the staminal tube, not free, the 5 not 3-celled ovary, the superposed, not collateral ovules, and by having a membranous tube sheathing the ovary and base of the style.

Jussieu and Meisner adopt Blume's genus *Aphanamixis* in preference to Roxburgh's *Amoora*, a much older name. The former does not seem to be aware of the existence of Roxburgh's name, the latter is, and puts the question "*An tamen Amoora*, (Roxb.) *exclusis omnibus spec. præter A. Rohitukam*, (W. and A. p. 119,) *servanda*, ?" in my opinion a very unnecessary question, since unless we are to depart from the old established rule of priority, which must lead to incalculable confusion, Roxburgh's name, as being the older, whatever be the number of species described under it, must be adopted in preference to a more recent one. Of this genus, under the name *Aphanamixis*, Jussieu enumerates three species not including either of the Indian ones, of which there are two described by Roxburgh, Fl. Ind. under the name of *Andersonia*: one of these was afterwards figured in the Coromandel Plants under the name of *Amoora*, the former name, having been in the mean time occupied by Mr. R. Brown, for a new Holland genus. Of this genus I have now three Peninsular species, namely, *A. cucullata* ? Roxb. *A. Rohituka*, W. and A. and one apparently a new species, with subsessile fruit, springing direct from the branch like figs *A. ficiformis*. This last I have not seen in flower, but the form of the fruit, leaves no doubt of the genus, and the absence of a peduncle either in form of panicle or spike at once distinguishes it from the other two.

These are the only additions to the order I have met with on the continent, but from



Rungia del

MUNRONIA NEILGHERRICA.

Ceylon I have specimens of a plant apparently belonging to it, and most probably a species of *Xylocarpus*, but which, for want of fruit I am unable with certainty to determine. The calyx is cup-shaped, obtusely 4-lobed, the petals 4, stamens 8, the filaments forked at the apex, with the anther in the division, the ovary 4-celled, with two collateral pendulous ovules in each, stigma truncate. Should it prove a species of that genus it is probably new. The genus *Munronia*, I have dedicated to my friend Lieut. Munro, the late Secretary to the Mysore Agricultural and Horticultural Society, and a most persevering investigator of the plants of that portion of India. I extract the following generic character from my Icones Plantarum Indiæ Orientalis, No. 91, where a second species is figured.

MUNRONIA, R. W.

Calyx 5, rarely 4-cleft. Petals 5, cohering at the base, with the staminal tube. Anthers 10, attached to the apex of a slender funnel-shaped tube, alternate with its teeth, exserted. A tube sheathing the ovary and base of the style. Ovary 5-celled, cells 2-ovuled, ranged round a thick central placenta. Ovules superposed. Style filiform, stigma discoid—capitate. Capsule 5-valved, valves septiferous, loculicidal. Seeds by abortion about 5, attached to a large pyramidal persistent placenta. Embryo enclosed in a thin fleshy albumen. Cotyledons foliaceous, radicle pointed remote from the hilum, projecting. Small erect shrubs, with the leaves congregated near the summit. Leaves pinnate; leaflets one or several pairs opposite, glabrous. Peduncles axillary, one or several flowered, flowers white, sometimes fragrant.

This genus which I have named in honor of my zealous and enterprising friend, Lieut. Munro, H. M. 39th Foot, is most nearly allied to *Naregamia*, but abundantly distinct and readily distinguished by its 5, not 3-celled ovary, and its superposed not collateral ovules.

M. pumila, (R. W. Icones plant. Ind. Or. No. 91) Leaves trifoliolate, the terminal one much larger than the lateral leaflets.

Melia pumila, *Moon! Catalogue of Ceylon plants*, p. 35.

Hab.—*Ceylon.*

Moon's specimens I had an opportunity of examining, and I have specimens collected by Colonel Walker.

M. Neilgherrica, (R. W.) Shrubby, leaves congested towards the summit, unequally pinnate, about 3-paired, leaflets ovate, acute, glabrous: cymes several, axillary and terminal, lobes of the calyx foliaceous, hairy.

Hab.—*Neilgherries and Coorg.*—Munro.

A charming low shrub, with pure white very fragrant flowers.

M Wallichii, (R. W.) Shrubby, leaves unequally pinnate, leaflets about 3 pairs, obliquely cordate at the base, tapering towards the point.

Turræa pinnata, *Wall. Pl. as. rar.* 2. 21. *tab.* 119.

Hab.—*Silhet.*

This species I only know from Wallich's plate and description, which, though defective in the analysis, agrees so well in habit as scarcely to leave a doubt of its being a species of this genus. Jussieu in his memoir remarks, that this plant does not belong to the genus *Turræa*, and doubts whether it belongs to the tribe *Melieæ*, but thinks there can be no doubt it belongs to the *Trichilieæ*, though he is uncertain to which genus it ought to be referred. He adds "that it seems to approach most nearly to *Hartighsea*, by the union of its petals with the base of the staminal tube, and by the little fleshy tube which embraces the ovary and base of the style. Dr. Wallich however, supposes that the ovary has 5 cells, with 5 erect ovules, but these characters he gives with marks of doubt, and does not know the fruit or seed." In all the points here stated, except the solitary erect ovules, a point not very easily ascertained, the plant agrees with my genus and affords additional evidence of its being a species of it and not of *Hartighsea*, which has a 3, rarely 4-celled ovary. On this supposition, I have taken the liberty of referring it here and changing the specific name as all the species have pinnate leaves.

AMOORA.

A. ficiformis, (R. W.) Leaves pinnate, leaflets ovate, oblique at the base, fruit ficiform, axillary, solitary, subsessile.

Hab.—*In Woods.—On the Shevagherry mountains near Courtallum.*

My specimens are too imperfect, being in fruit only, to admit of my giving a more detailed character. From the same locality I have a specimen of a species, also in fruit, with panicled inflorescence, in so far agreeing with Roxburgh's *A. cucullata*, which species I presume it is, and now add it also to the Peninsular flora. The three species may be thus briefly distinguished.

A. cucullata, Roxb. female flowers panicled.

A. Rohituka, female flowers spiked.

A. ficiformis, female flowers axillary, solitary, or from the scars of fallen leaves, subsessile on the branches.

EXPLANATION OF PLATE 54.

1. Munronia Neilgherrica, *natural size.*
2. A detached flower, calyx 5-sepaled.
3. Another flower, dissected, the staminal tube split open, showing the sheath of the ovary, style and stigma, calyx in this instance 4-sepaled.
4. Back and front views of anthers.
5. Ovary cut transversely, showing its 5 cells placed round a thick fleshy axis.
6. Ovary cut vertically, showing the ovules superposed.
7. A full grown capsule—*natural size.*
8. The same dehiscing, dehiscence loculicidal.
9. A single valve detached.
10. A seed, not quite mature—*natural size.*
11. The same, the testa removed, showing the large as yet soft albumen.
12. The same divided, showing the embryo with the radicle next the hilum—*with the exceptions mentioned, all more or less magnified.*

The drawing of the plant is made from a preserved specimen—that of the fruit from a fresh capsule, both communicated by Lieut. Munro.

EXPLANATION OF PLATE 55.

1. Walsura piscidia, *natural size.*
2. A detached flower.
3. The same, the petals removed to show the deeply cleft staminal tube.
4. Detached stamens, back and front views.
5. Stamens removed, showing the annular disk with immersed ovary, the short style and large 2-cleft stigma.
6. The ovary cut vertically.
7. The same cut transversely, 2-celled, with two collateral ovules in each.
8. A fruit full grown—*natural size.*
9. The same cut transversely.
10. The same opened, showing the arillus with its enclosed seed.
11. A seed detached—*natural size.*
12. Cut transversely—*natural size.*
13. A seed lobe, the radicle next the hilum—*with the exceptions mentioned, all more or less magnified.*

ERRATUM.

For Walsura friscidea on the plate *read* piscidia.

XL.—CEDRELACEÆ.

This small order, long united with the preceding, and even now considered by some eminent Botanists as at most a sub-order, ranks among its species some of the most magnificent trees of the forest, not less famed for their size, than for the beauty of their timber; not the least remarkable of which, in both these respects, is the Mahogany of America, and in the latter, the Satin wood of this country. It is principally distinguished from the preceding by its flattened, winged, exalbuminous seed. Adr. de Jussieu gives the following character of the order.

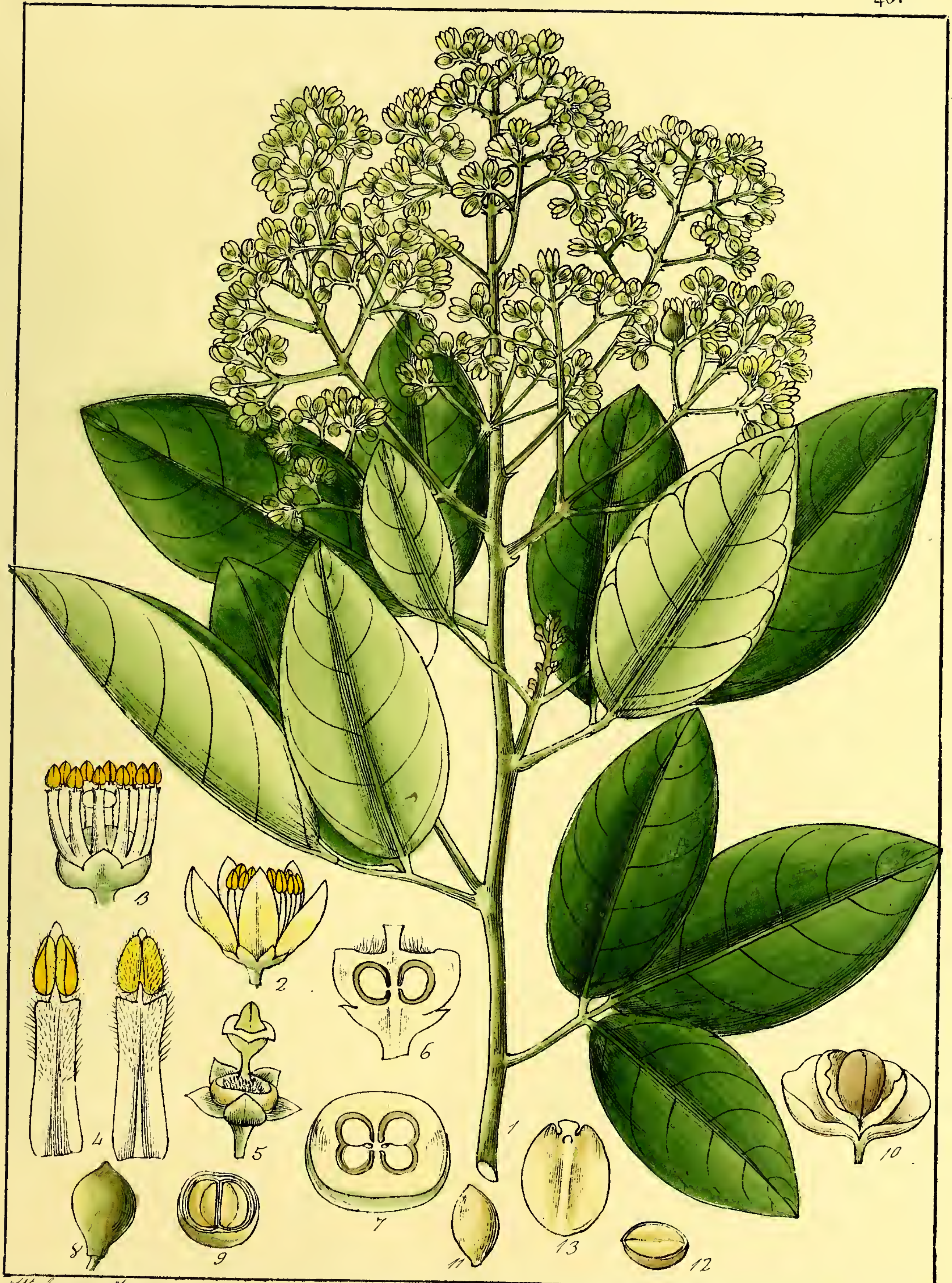
Calyx 4-5. cleft. Petals 4-5, longer. Stamens 8-10, either united into a tube (*Swietenieæ*) or distinct (*Cedreleæ*) and inserted into an hypogynous disk. Style and stigma simple, cells of the ovary equal to the number of petals or fewer (3) with 4, or often more, ovules, imbricated in two rows, fruit capsular, with the valves separable from the dissepiments with which they alternate, (or, in *Chloroxylon,* adherent, with loculicidal dehiscence). Seeds flat winged, albumen thin or none.

Trees, usually with hard fragrant, and beautifully coloured wood, alternate, exstipulate, pinnated leaves. Panicles terminal or subterminal, large, rarely axillary. Flower imperfectly bisexual, that is, the ovaries of some becoming depauperated and sterile with polleniferous stamens, while in others the pollen is wanting and the ovary is perfect and fertile.

AFFINITIES. These are the same as *Meliaceae*, from which they are chiefly distinguished by their winged and indefinite seeds. The pellucid dots in the leaves of *Chloroxylon* establish another link of affinity between these orders and *Aurantiaceae.*

GEOGRAPHICAL DISTRIBUTION. Like *Meliaceae* these are natives of the tropics, or the warm countries bordering on them, but have as yet principally been found in America and Asia, only one has been met with in Africa or the adjoining islands. When Jussieu published his memoir in 1830, 14 species only were known to him, and I am not aware of the list having since then been augmented by the publication of additional species. I have however recently received from Mr. Nimmo, of Bombay, specimens of a *Chickrassia,* which he thinks new, and which so far as I am enabled to determine from a somewhat imperfect specimen is distinct from *C. tubularis.* Mr. Graham of that place has named this species *C. Nimmonii.* It is described as a very large tree, and differs from my specimens of *C. tubularis* in having thick coriaceous leaves, softly villous on the under surface, in place of membranous and perfectly glabrous on both sides. The specimen not being in flower I am unable to carry the comparison further, but I think it will prove a good species. I am not at present aware of any other addition to the order.

PROPERTIES AND USES. Nearly all the species of this order are remarkable for some useful property. The *Swietenia Mahogoni* affords the beautiful and highly prized Mahogany wood. The bark of the *Soymida* (Swietenia) *febrifuga* of Roxburgh is said to possess antiseptic and febrifugal properties, but little inferior to the Cinchona bark; it is also employed by the natives for dying, while the timber is but little inferior in hardness and durability to teak, and acquires a very large size. The *Chickrassia tubularis* supplies the well known Chittagong wood so much used in



Walsura (Tam)

WALSURA PRISCIDIA. (ROXB:)

Walursi (Tel)

CHLOROXYLON SWIETENIA. (DC.)

this country by the cabinet-maker, while the *Chloroxylon Swietenia* affords the beautiful and fragrant Satin wood, and lastly, the Toon tree (*Cedrella toona*) inferior to none of the others furnishes a beautiful timber, resembling Mahogany, while the bark has nearly all the medicinal properties of the *Soymida*, and lastly, the flowers are used in Mysore in dying cotton, a beautiful red colour. Endowed with so many useful properties it seems desirable that the cultivation of almost every species should be attempted on a large scale. The Chittagong wood tree, the Toon and the Satin wood, are all found in the neighbouring jungles, and I think also, the *Soymida*, but I have not seen them in cultivation.

REMARKS ON GENERA AND SPECIES. The genera of this order, like those of *Meliaceae*, naturally divide themselves into two sections, those namely, having the filaments free to near the base, and exalbuminous seed, (*Cedreleae*) and those having their filaments united into a tube and albuminous seed: to the first of these sections *Cedrelae* and *Chloroxylon* belong, to the second *Chickrassia* and *Soymida* are referable, and with the exception of the new species of *Chickrassia* no recent additions have been made. The accompanying plates exhibit a species of each of these tribes.

EXPLANATION OF PLATE 56.

1. Chickrassia tubularis, *natural size.*
2. A flower, fully expanded.
3. Stamen tube split open, showing the ovary, style, and stigma.
4. Anthers back and front views.
5. Ovary cut transversely, 5-celled, with two rows of ovules in each.
6. The same cut transversely.
7. A full grown fruit.

EXPLANATION OF PLATE 57.

1. Chloroxylon swietenia, *natural size.*
2. An expanded flower.
3. Stamens back and front views.
4. Ovary and cup-shaped torus.
5. Ovary cut vertically.
6. Cut transversely, 3-celled, with several ovules in each cell.
7. A full grown capsule burst, showing it 3-valved, with loculicidal dehiscence.
8. Cut transversely.
9. A valve of the capsule, showing the seed imbricated.
10. A seed, the apex winged.
11. The same, cut obliquely across the base.
12. A seed cut transversely, showing the wing.
13. A seed lobe, with the radicle superior—*all more or less magnified.*

XLI.—AMPELIDEÆ.

This small, but from including the Grape-vine, very important order, for the most part consists of diffuse or scandent plants, climbing by means of tendrils, and is with few exceptions confined to the tropics or the warm countries bordering on them, but within these limits its species abound.

In most modern systems of Botany it is divided into two suborders, *Viniferae* and *Leeaceae*, the former characterized by their sarmentose scandent habit, and by being furnished with tendrils (sterile peduncles) opposite the leaves, by the petals and stamens being distinct to the base, and by the ocillatory anthers: the latter by the plants not being scandent and without tendrils, by the petals, usually, united at the base, by the stamens being monadelphous and by the anthers not ocillating.

Calyx small, nearly entire. Petals 4-5, inserted on the outside of a disk surrounding the ovary, inflexed on the margin: æstivation valvate, often somewhat hooked in and cohering at the point. Stamens equal in number, and opposite the petals, inserted upon the disk, sometimes sterile by abortion; filaments distinct, or, in Leea, cohering at the base, and forming a thick fleshy urceolus, anthers ovate, versatile, or in Leea fixed, by the cohesion of their margins. Ovary superior, 2-3 celled, with the ovules erect in pairs, or 6-celled,with solitary ovules. Berry round, often by abortion, 1-celled, pulpy: seeds 4-5 or fewer, erect, bony; albumen hard. Embryo erect, about half the length of the albumen, radicle tapering, cotyledons plano-convex, or subfoliaceous. Shrubs with tumid separable joints. Leaves furnished with stipules at the base, often very variable in form on the same plant being simple and entire, or variously lobed; affording very unsatisfactory specific characters. Peduncles racemose, or cymose, sometimes changing to tendrils opposite the leaves; flowers small, greenish or purple.

Affinities. These appear to be very imperfectly understood at least if we may judge from the different positions in which different authors place the order, which however is not a good criterion. Jussieu placed it between *Meliaceæ* and *Geraniaceae*—DeCandolle retains it in the same situation, Bartling (Ord. Naturalis) forms a class of this and *Meliaceae*, but still retains it beside *Geraniaceae*, Lindley in the first edition of his Introduction places it between *Malpighiaceae* and *Meliaceae*, but far removed from *Geraniaceae* and *Pittosporeae*, and still further from *Berberideae*, while in the second edition it is placed between *Berberideae* on the one side and *Pittosporeae* on the other, but still far from *Geraniaceae*. Meisner retains it nearly in the old place between *Meliaceae* and his class *Malpighinae*, (see page 137) which last is followed by his class *Geraniodeae*. To decide between such authorities is more than I dare attempt, but upon the whole feel disposed to adopt in preference the Jussieuian arrangement, though it places the order in a situation where, so far as I can see, it has no very close relationship with those on either side, nor indeed do I think its affinities well made out any where. In the artificial arrangement of the orders adopted by Jussieu it is very conveniently placed at the end of a series of orders, having some well marked affinities, and separates another set, forming the *Gynobasious* group of Lindley, at the head of which the *Geraniodeae* may be, and is by most authors, placed; though in Lindley's arrangement, they form the second of the four Alliances into which he divides that group. As a strictly natural arrangement Lindley's perhaps approaches the nearest to perfection, but with this evident disadvantage that the *group* in which he places the order (*Albumenosae*) is distinguished by a character not always easily made out, and subject to some striking exceptions, such as excluding many genera in which albumen abounds, and including at least one order (*Nelumbiaceae*) in which it is wanting. One half of *Meliaceae* and of *Cedrelaceae*, have each, with many others, albuminous seed, but in smaller proportion, yet do not find a place in this group. From this, and innumerable similar instances which may be cited of irregularities in this part of the structure of seed I do not see, even taking proportion into consideration, how any arrangement made to depend on it, can be good in practice, as applied to orders until a higher value is assigned to it, though perhaps it may occasionally be employed as a useful generic character, though even that is doubtful. The genus *Cassia*, for example, as now constituted has at least two species *C. fistula* and *C. Roxburgii*, having very copious albumen while most of the others are exalbuminous. In such cases the presence of albumen may be advantageously employed to aid in removing badly associated species from an otherwise natural genus, and in this instance confirms the judgment of those who had previously separated the genus *Cathartocarpus*, on account of the irregular structure of its legumes. But while we meet with similar irregularities of structure, in so far as this organ is concerned, in almost every family, it is surely a questionable arrangement which brings together a series of upwards of twenty orders, many of them, so far as I can see, having scarcely any other mark of relationship, merely because they agree generally, but not universally, in having seed with a copious albumen and small embryo. For these reasons I am not yet prepared to adopt Dr. Lindley's arrangement in that particular group, though far from thinking that we ought to lose sight of the idea which led to its formation, since, if thoroughly investigated some important relations may be found to exist between albuminous seed and vegetable structure generally, which has not yet been discovered, but which may ultimately tend to modify our whole system, much in the same way as the discovery of Exogenous and Endogynous structure, being connected with the structure of the seed, has given stability to the classification of the whole vegetable kingdom according to that structure. Upon the whole then I think we may safely conclude that our knowledge of vegetable structure is not yet sufficiently advanced to admit of our constructing a system on such principles, and that therefore, for the present the safe course to pursue is to arrange our natural orders according to some convenient artificial system suited to facilitate the investigation of new plants, though we ought never to forget for a moment, that such is not the object of our studies, but the discovery of a truly natural system throughout. Here I leave the subject merely observing that *Araliaceae* is the order to which this seems most nearly to approximate, though abundantly distinct, and in the structure of the seed, even to *Rubiaceae*.

Geographical Distribution. Principally confined to the tropics and warmer countries of the temperate zones, very numerous in India, less so in America and Africa, but found in both. According to Wallich's list there are 53 species of *Vitis* including *Cissus*, in India, while in the Peninsula we enumerate 26. He again has 13 species of *Leea*, while we have only three.

DeCandolle has of these genera 107 for the whole world. How far these numbers will require to be modified by future experience it is not easy to say, but I suspect when all the species are well examined, and with sufficient specimens, many will be reduced, and leave the numbers, when many new ones are added, nearly the same as they now stand. This I think will prove the case because the leaves, from which specific characters are usually taken, of no set of plants I have ever examined, afford specific characters less to be depended upon than those of the genus *Vitis,* unless perhaps *Bryonia* the forms of the leaves of some of the species of which are to the full as variable.

Java according to Blume has 34 species of the order, and 5 genera. India has 4 genera including *Cissus* and *Ampelopsis.* The former of these however only differing from *Vitis* in having a quaternary in place of a quinary order of parts, with some difference of habit, and the latter being similarly situated, agreeing with *Vitis* in having a quinary order, but with the habit of *Cissus,* cannot be kept distinct.

Properties and Uses. The properties of the Grape whether recent or dried, not less than the products of its fermented juices, the various kinds of wine, are too well known to require to be dwelt upon here. The leaves of some, or perhaps most, of the species are acid, and some astringent, while the fruit of several are intensely acrid. The berries of the *Cissus quadrangularis,* the young shoots and leaves of which are used by the native as a pot herb, are so exceedingly acrid, that it is sufficient to taste one, to cause in a short time the most insufferable sense of burning all over the mouth and fauces of several hours duration. How many more produce similar effects I confess I have not had the courage to try, having suffered so severely in that instance. Generally speaking, however, I believe it may be safely assumed, that with the exception of the Grape-vine, none of the species possess valuable properties. I have heard that the fruit of one or more species is used in this country for making vinegar, but as this product of fermentation can be procured from so many vegetable juices this application can scarcely be viewed an exception to the general rule.

Remarks on Genera and Species. The genera of this order, which are few in number, divide themselves as already observed into two tribes or sub-orders, the *Leeaceae* and *Viniferae.* Of the former *Leea* is the type, and indeed only certain genus, two others being placed here with a doubt, but neither natives of India ; the latter is represented by *Vitis* including *Cissus* and *Ampelopsis,* which are undistinguishable by any set of marks on which even good sectional differences in any other order would be established. These therefore, Mr. Brown has very justly proposed to unite, though in this, he has not been followed by the generality of writers. *Cissus* has a 4-lobed calyx, with 4 petals, 4 stamens, and a 4-angled disk. *Vitis* and *Ampelopsis* have each 5 petals and stamens, with some slight differences of habit which may enable a person conversant with either to distinguish the other, but a *Cissus* with pentandrous flowers would at once become an *Ampelopsis* or *Vitis* according as it retained the habit of *Cissus,* or approached that of *Vitis,* and a tetrandrous specimen of either of the others, would become a *Cissus.* Characters so entirely dependent on number not being admitted in other families, neither ought they to be in this. The only other genus therefore referable to this section is Blume's *Pterisanthes,* a Java plant, with quaternary flowers, but otherwise well distinguished by a foliaceous lobately winged involucrum, with which they are furnished. Blume considers it intermediate between *Cissus* and *Ampelopsis* which it may be, if both are retained.

The discrimination of the species of this order is unquestionably difficult, and if the characters by which this is attempted, be taken from the foliage, the species so formed will rarely prove permanent, as there is no end to the variations of form to be met with in the same species; nor is it easy to say which set of organs afford better characters, hence, to succeed, all must be laid under contribution as much so as in defining a genus in any other order. On this principle the specific characters of our Prodromus were constructed, and are I believe the most perfect so far as they extend (the Peninsular species) yet extant, but even with these, the discrimination of species from varieties is not always attainable. Subsequent experience, since preparing that Monagraph of the Peninsular *Vitices,* has not enabled me to add either new species or new marks for their more certain determination, on which account, I beg to refer to that work for all the information I myself possess respecting the species of this order appertaining to the Flora of southern India. The plates exhibit a species of each section. This

was necessary as the *Leeaceae* are by some very eminent Botanists viewed as a totally distinct order from *Viniferae*, and it must be confessed not without good reason, or at all events as good, or better than those for separating *Malvaceae* from *Bombaceae* or *Byttneriaceae*, and *Elaeocarpeae* from *Tiliaceae*, and many others. Between *Viniferae* and *Leeaceae* there is difference of habit, great difference in the structure of the flowers, especially as regards the stamens, and in the number of cells and ovules of the ovary. There are no doubt affinities sufficiently marked to render their union desirable but on the same principles, so should the others be separated by sectional divisions only. I have alluded above to the difficulties of distinguishing the species of *Vitis*, with respect to *Leea*, these are not much diminished, and as in the former case, I beg again to refer to the Prodromus for characters, since I have not been able, after much consideration, to improve those given in that work, though I have examined many specimens of every form.

EXPLANATION OF PLATE 57.

1. Vitis tomentosa, *natural size.*
2. An expanded flower, petals not adherent at the apex.
3. The same, the petals removed, showing the cup-shaped torus and ovary.
4. Stamens back and front views.
5. Ovary cut transversely, 3-celled, with 5 ovules.
6. The same cut vertically, showing the ovules erect.
7. Back and front views of the seed—*natural size.*
8. The same magnified.
9-9. Seed and fruit cut transversely, showing the large conferruminate albumen.
10. A seed cut vertically, to show the embryo at the base of the albumen, but not well represented.
11. The embryo removed—*all with the exceptions mentioned more or less magnified.*

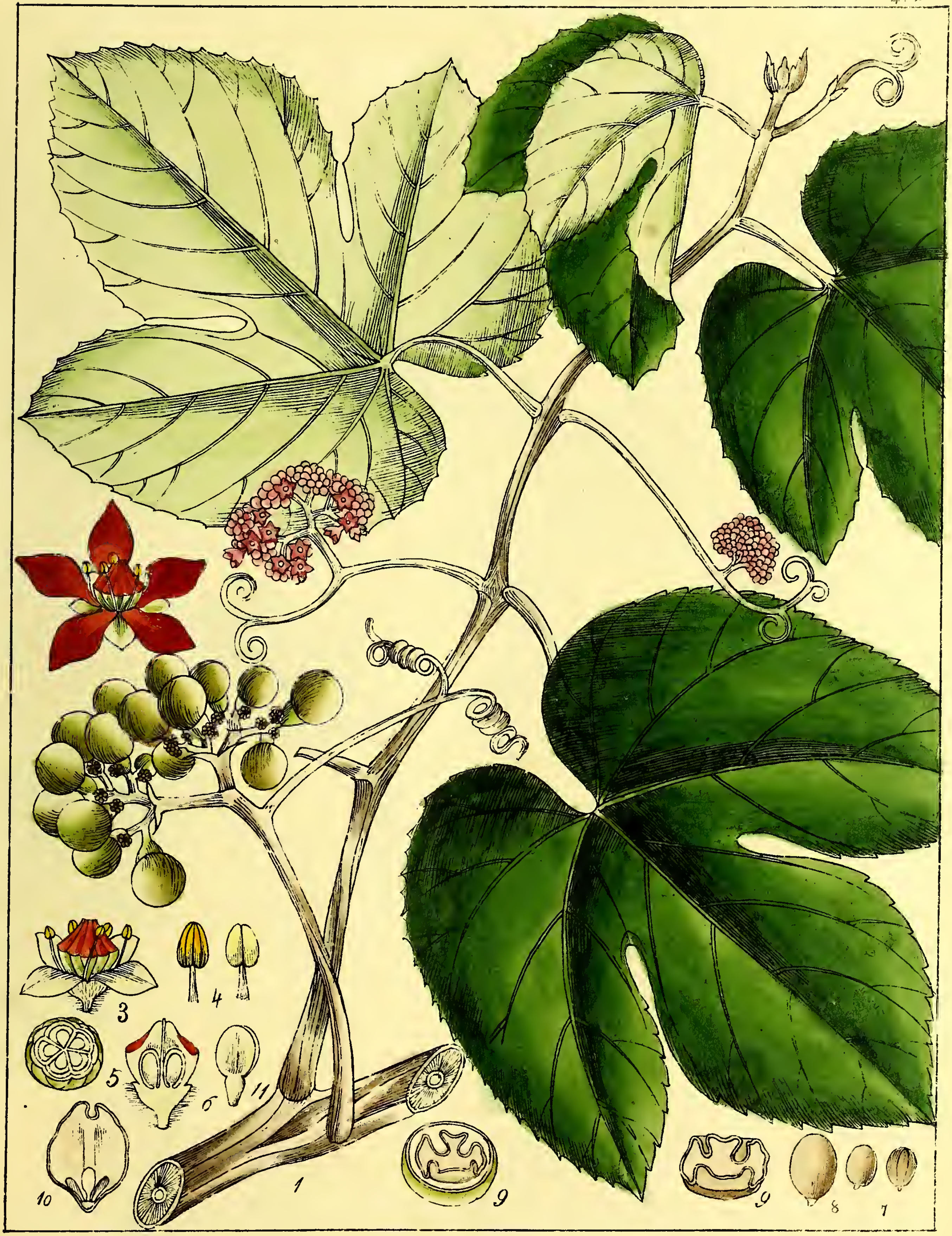
EXPLANATION OF PLATE 58.

1. Leea Staphylea, *natural size.*
2. An expanded flower, with the stamen tube *in situ.*
3. The stamen tube removed and split open, to show the position of the anthers.
4. Front and side views of the anthers.
5. Calyx and ovary, with the style and stigma.
6. Ovary cut vertically.
7. The same cut transversely, in this instance 4-celled, with one ovule in each.
8. A full grown fruit.
9. The same cut transversely, in this instance 6-celled, with one seed in each.
10. A seed.
11. The same cut transversely, showing the large albumen.
12. Another cut vertically, showing the position of the embryo and its relative size to the albumen.
13. The embryo removed.

XLII.—GERANIACEÆ.

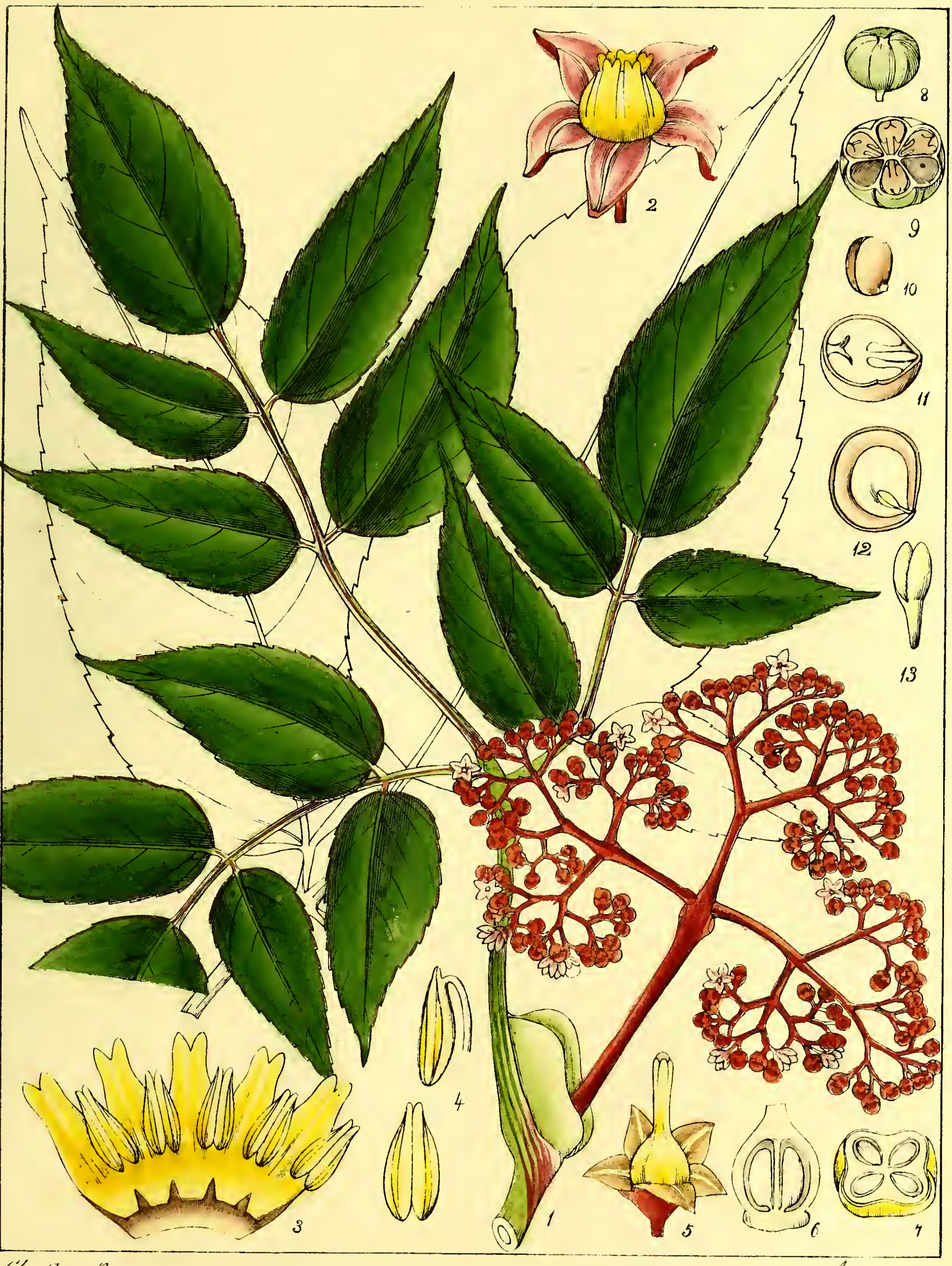
This order may be viewed as almost entirely of extra-tropical origin, for though a few species are indigenous within the tropics, these are almost invariably found on the higher hills where temperature is reduced by elevation. The Indian Peninsula seems generally unfavourable to the production of plants of this order, since, so far as yet known only one species has been found native even on the highest hills, and in Ceylon the same species only occurs. It consists of herbaceous or suffruticose plants, with the stems usually jointed, the leaves opposite below, and frequently alternate above, palmately nerved and cleft, or pinnatifid, and furnished with two foliaceous stipules. The flowers are more or less irregular, bisexual, paired, or umbelled, seldom solitary, on axillary, or occasionally, leaf opposed peduncles.

Sepals 5, persistent, imbricated in æstivation, sometimes produced at the base into a spur, connate with the pedicel. Petals 5, sometimes 4, or wanting, by abortion, unguiculate, equal and hypogynous, or unequal, and either connected at the base or inserted on the calyx; æstivation twisted. Stamens usually monadelphous at the base, hypogynous, or perigynous, rarely free, twice or thrice as many as the petals. Ovarium 5-celled, with two ovules in each, styles 5, cohering round a central elongated axis or torus (gynobase). Fruit, of 5 membranous 1-celled, indehiscent carpels, which are at first close pressed to the gynobase, each ending in its style, which is closely adnate to the angles of the axis, but afterwards twists variously from the base to the apex, and carries the pericarp with its enclosed solitary seed along with it. Seed peritropal, albumen none. Embryo curved, radicle superior, but with its point bent down towards the hilum. Cotyledons foliaceous.



காட்டுமுந்திரி. **VITIS TOMENTOSA (HEYNE)** ఒడ్డెవద్రాక్ష

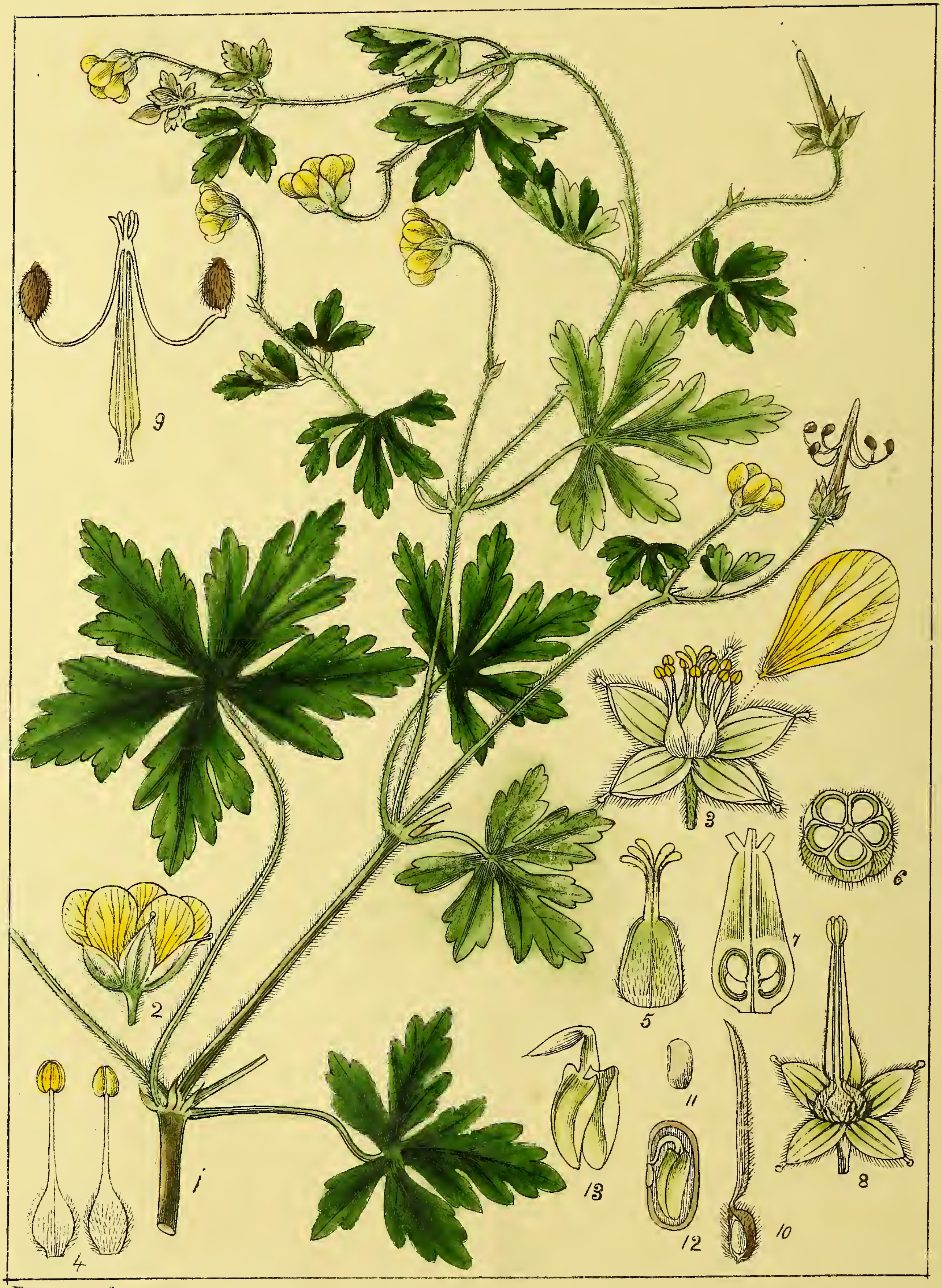
Cautoo Moondri_Tam. *Uddevel_dracha (Tel.)*



Cheethee. B.

LEEA STAPHYLEA (ROXB.)

Ancados. J.



Rungia del

GERANIUM AFFINE. (W & A.)

Affinities. Nearly all Botanists agree in associating this order with the three following ones, and some, among whom is Mr. Arnott, consider them as either so many sub-orders or at all events members of a class. Meisner adopts this last suggestion and combines them under his class *Geranioideæ.* DeCandolle and Lindley, however remove *Lineæ,* the latter Botanist, on account of its wanting the gynobasic structure, and place them near *Caryophyllaceae,* while Bartling retains *Lineae* here, but separates *Balsamineae* and places them among his "*Ordines insertæ sedis.*" Amidst such conflicting opinions none but the highest authority can determine the place these orders ought to occupy, and as I am far indeed from thinking myself qualified to solve the difficulty I leave the matter as I find it: but, were it part of my plan to re-arrange in place of merely to illustrate the orders as they stand in our Prodromus, I think I should revert to DeCandolle's arrangement from thinking *Lineae* more nearly allied to *Caryophyllaceae* and *Malvaceae,* than to *Geraniaceae* and *Balsamineae,* nor can I feel surprised that Bartling expresses himself doubtful of the place which *Balsamineae* ought to occupy, for, the order, though itself well defined, is certainly a very curious one in some points, especially in its very irregular flowers and peculiar character and dehiscence of its fruit, the normal structure of which, until elucidated by *Hydrocera* could not be so satisfactorily explained. Lindley in his 4th group of Polypetalous plants, *Gynobasiosae,* associates a series of 10 orders all participating in this (gynobasic) structure, arranged under four sub-groups or Alliances, and thus, excluding *Lineae,* brings together a very extensive and natural assemblage of plants, agreeing in more or less distinctly, possessing a gynobase, some it is true less evidently so than others, but in all distinguishable. In addition to its affinities with the *Gynobasic* group *Geraniaceae* approaches *Malvaceae* in its lobed stipulate leaves, monadelphous stamens, and convolute embryo: from *Oxalideae* it is separated by its beaked fruit, stipulate leaves, and absence of albumen which is present in *Oxalideae,* in habit, and some other points, it approaches *Ampelideae.*

Geographical Distribution. A very extensively but unequally distributed order. In Europe several are found as well as in North America, but most abundant at the Cape of Good Hope. In Asia a few are found, Mr. Royle states that about 15 are natives of the Himalayas, one only has yet been found in the Indian Peninsula and Ceylon, and that confined to the elevated regions of the Neilgherries and Pulney mountains in the former; and in the latter to the most elevated portions of the Island. The Cape is remarkable for the number of its *Geraniums,* or rather *Pelargoniums,* now so generally cultivated all over the world, and esteemed, not less, on account the richness of the colours of their flowers, than on account of the strong and peculiar fragrance of their leaves.

Properties and Uses. Under this head I have nothing to offer, some of the species are astringent, and the root of one North American species has received, in allusion to this property, the name of Alum root. They have generally an aromatic or resinous flavour.

EXPLANATION OF PLATE 59.

1. Flowering branch of Geranium affine, *natural size.*
2. A flower.
3. The same, the petals removed to show the stamens and ovary.
4. Back and front view of the stamens.
5. Ovary detached.
6. The same cut vertically, showing the two superposed ovules, but incorrectly represented ascending.
6. The same cut vertically.
7. A fruit near maturity.
8. The same, after the carpels have become detached from the Gynobase.
9. A carpel opened, showing the position of the seed.
10. A seed.
11. The same dissected, showing the embryo *in situ.*
12. Embryo removed—*all more or less magnified.*

XLIII.—LINEÆ.

A small order of herbaceous and suffruticose plants, generally speaking of very minor importance, one species however, the common Lint or Flax plant (*Linum usitatissimum*) is of great value in the arts, on account of the fineness and strength of the fibres of its bark, and the peculiar qualities of the oil of its seed. The stems and branches are round or irregularly angled, the leaves usually alternate, rarely opposite or verticelled, simple, entire, exstipulate, but sometime furnished in place of stipules, with small glands at the base of the leaves. The flowers are bisexual, regular, pedicelled, forming terminal cymes, rarely solitary and sessile.

Sepals 4 5, persistent, æstivation imbricated. Petals 4-5, hypogynous unguiculate, caducous, twisted in æstivation. Stamens equal in number to the petals and alternate with them, united at the base to a hypogynous ring or torus, from which proceed little teeth opposite the petals, indicating abortive stamens. Anthers ovate, erect, introrse. Ovary with about as many cells as sepals, seldom fewer, styles as many as the cells. Stigmas capitate, capsule, generally pointed with the hardened base of the style, several celled, each cell partially divided into two by an imperfect spurious dissepiment, and opening by two valves at the apex. Seeds single in each cell, compressed, inverted, albumen usually present. Embryo straight, fleshy, with the radicle pointing to the hilum. Cotyledons flat.

Affinities. These are still *sub-judice*, one set of Botanists viewing the order as more nearly allied to *Caryophyllaceae* and *Malvaceae*, while another considers it as little else than a section of *Geraniaceae*. The objection to this last arrangement, advanced by Dr. Lindley, the want namely of the gynobase, seems to me a very strong one, and in the absence of that I cannot see any other very evident relationship, by which the order approaches nearer the one set of orders than the other, and look upon DeCandolle's opinion, that it is an order intermediate between and having affinities with *Caryophyllaceae, Malvaceae,* and *Geraniaceae,* between the two first of which he places it, as well founded.

Dr. Lindley places *Lineae* in his Calycose group between *Elatineae* and *Hugoneaceae,* to both of which they are obviously allied.

Geographical Distribution. Species of the genus *Linum* are found in all the four quarters of the globe, but most abundant in Europe and the northern parts of Africa. Three are met with in the Peninsula of India, but perhaps one of these, *L. usitatissimum,* introduced, though that is uncertain now. Mr. Royle mentions some others which he found at the foot of the Himalayas, and at moderate elevations on them. The whole number enumerated by DeCandolle in his Prodromus is 54, Don in his edition has extended them to 77, but whether these are all good species may be doubted.

Properties and Uses. Flax the produce of the bark of the *Linum usitatissimum,* has been known and highly valued from a very remote period, on account of the beautiful cloth of which it forms the bases. In modern times, though less extensively employed now that the cheaper and more pleasant, but less durable, cotton cloths have come into general use, it still holds its place on account the strength and delicacy of the numerous and beautiful fabrics into which it is converted, among which may be mentioned the various kinds of Linen, Cambrics, Lace, &c. The preparation of the flax to procure it of the best quality is one requiring much care, and what seems remarkable has but recently attracted the attention and attained that degree of perfection which its commercial importance merits. The steeping or watering of flax, a process which injures its quality is still in general use. A modern improvement is, to steep the plant, whether green and fresh from the field, or after it has been dried and stacked for months, for a few hours in hot water and soft soap, which is said to separate the fibre from the woody matters better, than many days steeping in the usual way, and without rotting or deteriorating its quality. Great improvements have also been made in the machinery for cleaning flax, by which the process is greatly expedited, and a finer material produced, as will be seen in the following extract from Loudon's Encyclopædia of Agriculture, giving some account of the method.

" *Lees' method of breaking flax and hemp, without dew-retting,* was invented in 1810, and was the first step towards a great improvement, brought nearer perfection by the new patent machines of Messrs. Hill and Bundy.

Hill and Bundy's machines are portable, and may be worked in barns or any kind of outhouse, they are also well calculated for parish workhouses and charitable institutions, a great part of the work being so light that it may be done by children and infirm persons, and such is the construction and simplicity of the machines, that no previous instruction or practice is required, their introduction, therefore, into those asylums would be the means of effecting a considerable reduction of the poor's rate. The woody part is removed by a very simple machine, and, by passing through a machine equally simple, the flax may be brought to any degree of fineness, equal to the best used in France and the Netherlands, for the finest lace and cambric. The original length of the fibre, as well as its strength, remains unimpaired, and the difference

of the produce is immense, being nearly two thirds, one ton of flax being produced from four tons of stem. The expense of working each ton obtained by this method is only five pounds. The glutinous matter may be removed by soap and water only, which will bring the flax to such perfect whiteness, that no further bleaching is necessary, even after the linen is woven, and the whole process of preparing flax may be completed in six days."

This extract I introduce not in the hope that the plan can be rendered applicable to this portion of India, for the dressing of flax, though I think it may be to a very large extent in the upper provinces of Bengal where so much flax is cultivated for its seed only, but, under the impression that if the method here mentioned was adopted for the preparation of the flax-like fibres of the very numerous plants, natives of this part of India, producing them, they might be the means of furnishing us, from among them, with some very valuable articles for the fabrication of cordage and cloth in imitation of linen, or the Chinese grass cloth. The method of separating the fibres by steeping the plant for several days in water certainly impairs their strength and durability, an effect which the application of a weak alkaline solution does not, it would appear, produce, while it, through a chemical action, effectually removes the vegetable extractive and other matters with which they are combined in the plant, and so rapidly, as not to allow time for the partial decomposition of the fibres which results from the protracted immersion required for their separation, when that is accomplished by the simple process of steeping in water.

I shall conclude this too brief notice of an important subject, by another extract from Loudon's Encyclopædia of Agriculture, detailing a method of preparing flax to resemble Cotton in whiteness and softness, the principle of which may perhaps be found applicable to some one of the flax-like products of India.

" *A method of preparing flax in such a manner as to resemble cotton in whiteness and softness*, as well as in coherence, is given in *The Swedish Transactions* for the year 1747. For this purpose a little sea-water is to be put into an iron pot or an untinned copper kettle—and a mixture of equal parts of birch-ashes and quick lime strewed upon it; a small bundle of flax is to be opened and spread upon the surface, and covered with more of the mixture, and the stratification continued till the vessel is sufficiently filled. The whole is then to be boiled with sea-water for ten hours, fresh quantities of water being occasionally supplied in proportion to the evaporation, that the matter may never become dry. The boiled flax is to be immediately washed in the sea by a little at a time, in a basket, with a smooth stick at first, while hot, and when grown cold enough to be borne by the hands, it must be well rubbed, washed with soap, laid to bleach, and turned and watered every day. Repetitions of the washing with soap expedite the bleaching; after which the flax is to be beat, and again well washed, when dry, it is to be worked and corded in the same manner as common cotton, and pressed betwixt two boards for forty-eight hours. It is now fully prepared and fit for use. It loses in this process nearly half its weight, which, however, is abundantly compensated by the improvement made in its quality."

It only remains for me to add that the quantity of flax imported into Great Britain is about 1,000,000 cwts. annually, worth about $2\frac{1}{2}$ millions sterling and principally derived from the continent of Europe. At this rate it seems to be a subject deserving the attention of those in Bengal who cultivate the plant for the seed alone, to ascertain whether flax, fit for the English market could also be profitably prepared from it, in place of the whole plant, except the seed, being rejected as useless I certainly think, that this would be found to be the case, as a climate suited to bring the seed to perfection there is reason to believe might prove equally suitable for maturing the fibre, provided it can be removed and dressed uninjured by the operation. This may be doubted if the method of steeping is employed, but not so if the more scientific plan of dissolving the extractive matter in an alkali and then washing it away is pursued.

Linseed for the production of which, the cultivation of this plant is annually extending in Bengal, affords by compression a valuable drying oil, much used by painters. The remaining oil cake, is used for fattening cattle. From the seed a jelly is also prepared by slowly boiling it for about two hours, which is similarly employed by cattle feeders. In medicine, the infusion of the bruised seed forms an excellent demulcent, in various complaints requiring medicines of that description, the decoction affords a useful emolient enema in some cases of bowel complaint: while the meal, simply mixed with boiling water forms an excellent poultice of easy preparation. Linum catharticum " is bitter and powerfully, but, as it seems not danger-

ously cathartic ***. A drachm of the dried plant is a convenient purgative, or we may employ infusion of a handful of the recent plant. *Pereira*"—Lind. Fl. Med.

EXPLANATION OF PLATE 60.

1. Linum Mysorense, *natural size.*
2. A flower.
3. The same, the petals removed to show the sepals, stamens, torus and ovary.
4. Anthers back and front views.
5. Ovary and stamens.
6. A stigma.
7. A capsule—*natural size.*
8. The same magnified.
9. The same cut vertically—but very erroneously representing the seed erect in place of attached above the middle and pendulous: a point however very difficult to make out from the dried specimen.
10. A capsule cut transversely, showing it 5-celled, with two seed in each cell.
11. A seed—*with the exceptions mentioned, all more or less magnified.*

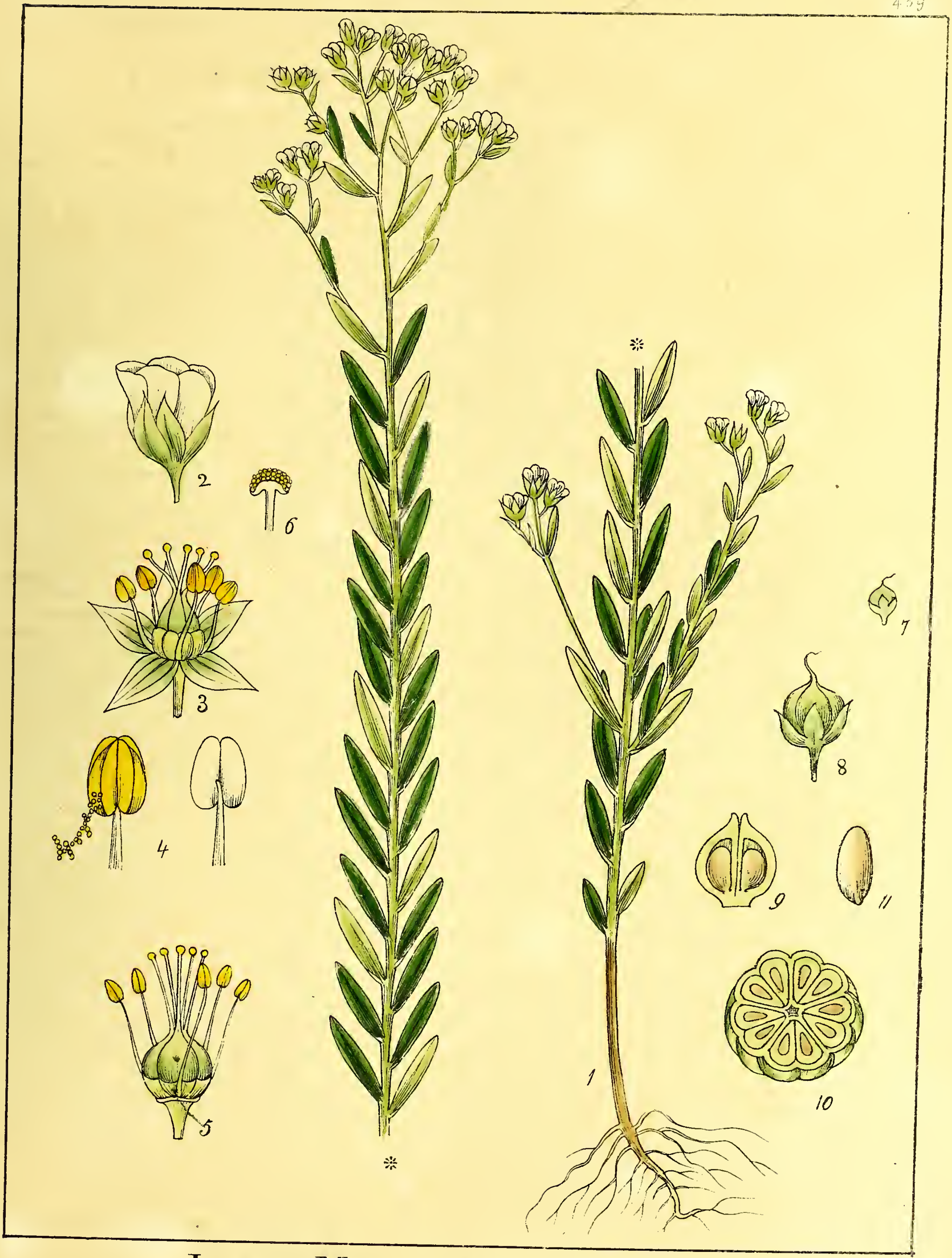
XLIV.—BALSAMINEÆ.

A small order of tender herbaceous succulent plants with round branches; alternate, or opposite, exstipulate, serrated, simple leaves: usually confined to marshy grounds, or to moist shaded situations, and of most frequent occurrence in warm humid climates within the tropics. The flowers are bisexual, irregular, axillary, solitary or fascicled, or racemose, pedicelled; white, red, or yellow.

" *Sepals* 5, or by abortion 3, irregular, deciduous, with an imbricated æstivation; the *two exterior* opposite, lateral, somewhat unsymmetrical, with a valvate æstivation, but giving way for the projection of the spur of the odd sepal; the *odd sepal* spurred, symmetrical, with an equitant æstivation in the bud, looking towards the axis of the axillary racemose or umbellate inflorescence, containing honey; the *two inner sepals* very small, sometimes scale-shaped, sometimes unsymmetrical, larger, orbicular, always coloured, appearing at the side of the flower, which is opposite to the spurred sepal, and at the base of the odd petal; (usually altogether abortive in Balsamina). *Petals* either distinct or a little adhering, 5, combined into 3, irregular, deciduous, alternate with the sepals; the *odd petal* regular, placed between the inner scale-like sepals, in front of the bract, wrapping up a great part of the remainder of the flower in æstivation; the *four remaining petals* unsymmetrical, united more or less on each side of the flower in pairs; their two larger lobes next the spur, their smaller next the odd petal; æstivation convolute. *Stamens* 5, symmetrical, alternate with the petals; those alternate with the odd petal longer than the others. *Carpels* 5, alternate with the stamens consolidated into a 5-celled ovary. (Roper abridged). *Stigma* sessile, more or less divided in 5, *cells* 5, two, or many seeded. *Fruit* capsular, with 5 elastic valves, and 5 cells formed by membranous projections of the placenta, which occupies the axis of the fruit, and is connected with the apex by 5 slender threads; sometimes succulent and indehiscent. *Seeds* solitary, or numerous, suspended; *albumen* none, *embryo* straight, with a superior *radicle* and plano-convex *cotyledons*."

This character is copied from Dr. Lindley's Natural System of Botany, and explains the views of Professor Röper, of Bale, of the structure of the flowers of this family which differs from that of Professor Kunth adopted in our Prodromus. These eminent Botanists take very different views of the construction of the flowers of this order of plants. Their differences may be thus explained—Kunth proceeds from a full grown flower, the spur of which is pendulous and appears on the same line with the bractea, that is, remote from the axis of the plant, (a line drawn through the stem,) hence, as the flower hangs on the stalk the spur is the lowest part, and if so placed that the axis of the flower, or a line drawn through its centre, is vertical will look towards the horizon in place of towards the axis of the plant.

Röper on the other hand commences his examination with the flower-bud, in the early stages of its growth, the spur in place of being the lower part of the flower next the bractea and remote from the axis is then on the upper part, and next the axis, showing clearly, that, in the progress of the flower towards maturity, the pedicel acquires a twist which changes, with respect to the axis, the relative position of all its parts. For the correctness of this last view the analogy of *Orchideae* may be adduced, in nearly the whole of which family, the pedicel becomes similarly twisted placing the lip of the flower, which in the bud is above, on the lower part. According to Kunth's view, the spur is the lower or odd sepal, the large upper segment of the flower two sepals united, and the two small green ones on either side are the lateral



LINUM MYSORENSE (HEYNE)

sepals, making a total of 5 sepals: while the two interior lobed petals he considers four petals united two and two, the fifth or odd petal, required to make up the normal number of 5 he supposes aborts, but ought to be placed on the upper part of the flower, opposite the large leaf which he supposes is formed by the union of the two upper sepals. Röper commences his examination with the young bud and finds the spur on the superior aspect next the axis, this therefore he considers the upper or odd sepal, the two green leaves the lower or exterior sepals, while between them and the lower leaf of the expanded flower, he finds two small scale-like sepaloid bodies, which however often abort, these he considers the inner pair of sepals. Kunth's upper united pair of sepals, which at this period are on the lower part of the flower opposite the spur he considers the odd or anterior petal, and the lateral lobed ones as double petals, thus making, up the number 5, the regular number of the genus. To trace the different stages of this theory which as being most consonant with the analogy of the rest of the vegetable kingdom, and especially with the *Orchideae*, appears to be the true one, it is only necessary to invert a flower of a balsam so as to place the spur uppermost as it is in the bud when the whole becomes evident. We then see the odd sepal above and the odd or anterior petal below, with one pair of the lateral sepals, (the other pair sometimes present, very small, but oftener absent from abortion) and the two pair of the lateral petals, but usually united below into a single 2-lobed petal.

In support of Kunth's view it may be urged that the interior petal of Röper is more analogous in texture to a sepal than a petal. This however is not an argument of much weight. In a practical point of view the difference is not of much consequence, since in describing the organ in question, for the purpose of deducing specific characters, it seems not to matter much, whether we call it a superior sepal or an inferior petal, so long as the part meant is clearly understood.

Affinities. I mentioned above that this order is considered by some Botanists nearly allied to the two preceding and to *Oxalideae*, but that others separate *Lineae* from the group on account of its wanting the gynobasi. This structure, the essential character of which is "Carpels seldom or never exceeding 5, always in a single whorl diverging at the base, and separated by the interposition of a conical gynobase, which throws them into an oblique position" (Lind.) is not so evident in the *Balsamineae* as in *Geraniaceae*, but still when sought for in the ovary, can be made out especially in the genus *Hydrocera*, where it is very distinct. Notwithstanding this mark of relationship Bartling does not see any affinity between these orders, and remarks that unless somewhat allied to *Fumareaceae* it is far removed from all other orders, and therefore places it at the end of this work along with some others, the place of which in the series he is uncertain about.

The *Tropeoleae*, or Nasturtium tribe, on the other hand, which other Botanists consider only a sub-order or section of *Balsamineae*, Bartling places in his class *Malpighinae* near *Sapindaceae*, while Mr. Don thinks them allied to *Capparideae*. Bartling's view is, I think, nearer the truth than Don's, as there is certainly many points of similarity between the orders though but little affinity.

Geographical Distribution. As affording the most complete view of this part of the subject, so far as I know, yet published, I shall here introduce some remarks which I formerly published in the *Madras Journal of Science*. merely adding, that since they were written I found several species not noticed in these introductory remarks, on the higher ranges of the Pulney mountains, and have by me drawings of seven species collected on the Neilgherries by Mr. G. Gough, several of which are new.

"Of this genus, now embracing nearly one hundred species, Linnæus only knew seven or eight; and most of these from indifferent figures. In 1805 when Persoon published his Synopsis, ten only were known; to these only six had been added in 1819, when Roemer and Schultes published the fourth volume of their *Systema Vegetabilium*, and one of the six "sine definitione." In 1824, Professor DeCandolle published the first volume of his *Prodromus*, and extended the catalogue from sixteen to thirty-one, excluding the undefined one, thus doubling the former number: of these, twenty-four are Indian, nearly all the new ones being derived from Dr. Wallich's Nepaul Collections. In 1830-31, Dr. Wallich named in his list no fewer than forty-seven Indian species. Since that time Mr. Royle informs us, (*Illustrations* page 151)

that his collection contains several not in Wallich's list, and Mr. Arnott writes me that he has recently described sixteen new ones from Ceylon. To these last, my excursions on the Courtallum and Shevagerry hills have added about as many more. Of the Courtallum ones, those only of which drawings were made, are introduced into this paper; not having, either specimens or sufficiently perfect notes, to enable me to define the rest.

It is a curious, and to me an inexplicable fact, that a genus so strikingly Indian, and associating such a host of species, should have been so little known to Roxburgh. He only describes three in his Flora, though I am sure I speak within bounds, when I assert that the countries, whence he derived the materials for his work, will be found to present an assemblage of not fewer than one hundred species. It is no doubt an eminently alpine genus, delighting in a cool and moist climate; hence it is unknown on the plains of Coromandel, though not unfrequent in Mysore, but, so far as I have seen, only abounding, in the Peninsula, on the higher hills participating in the western monsoon, which enjoy, during the hot months, a moderate range of temperature, with a very humid atmosphere. Some, (how many is not yet known,) are found during the monsoon on the Malabar coast, little elevated above the level of the sea, but, except in Tanjore, I have not seen one of the order on the plains eastward of the ghauts, beyond the influence of that monsoon: and the only one found there, is *Hydrocera triflora*, which grows, but is not common, in its ditches and swampy grounds, during the cool season, and is the only place where I have yet seen it.

This peculiarity of distribution may account for his not having met with Peninsular species, as he was but little in the southern provinces, and perhaps they are not found in the eastern range of the northern ghauts: but, twenty-two of the forty-seven species named by Wallich, are from Silhet, Pundooa and Nepaul, from all of which places Roxburgh procured plants, and one of the three he describes is from Silhet. A moist climate and moderate temperature are the circumstances most favourable, if not indispensable, to their production; hence we find twenty two, of the remaining twenty-five species named by Wallich, natives of the Peninsula, but confined to the ghauts and Mysore where these contingencies meet. This fact was first noticed by Mr. Royle, who, after remarking the nearly equal division of the forty-seven species between the frontier mountains of Bengal and the Peninsula, adds, " a singular equality of numbers, seeing that we have hitherto found Peninsular and South of India genera confined to the base of the mountains, and if found existing on them, generally only as single species; but here we have them in equal numbers, some of them extending to an elevation of seven thousand feet.

" This anomaly can only be explained, and a stronger fact cannot be adduced in its confirmation, than that the moisture and moderate temperature of the rainy season in the hills (for it is at this season only that they are found) is as favourable to their growth as the heat and moisture of the Peninsula. I have never met with any in the plains of India; but have heard from travellers that they are abundant in Central India, whence we may expect some new species, as well as from the Neilgherries."

The facts which I have mentioned regarding the distribution of the Peninsular species, go to prove, that heat and moisture are not the circumstances most favourable to their production here, but moisture combined with a moderate but equal temperature. At Courtallum for example, whence I have eleven or twelve species, they most abound in shady places on the tops of the hills, with a mean temperature during the season of their greatest perfection, not exceeding 70°, if so much. At Shevagerry, about fifty miles north of Courtallum, I found five, out of seven species, on the highest tops of the mountains; none of the five under 4,000 feet, and three of them above 4,500 feet of elevation; the mean temperature, as deduced from twenty observations, continued through four days, at an elevation of 4,100 feet, being 65° of Fahrenheit's scale. The two found at a lower elevation, were both either growing in the gravelly beds of streams, or immediately on their banks; the temperature of which was ascertained to be 65°, while that of the air at noon was only about 75°, a temperature, I presume, but little above that in which they delight on the Bengal frontiers. There is one other point, respecting the effect of climate on plants of this genus, to which I wish to call attention, as it may ultimately prove useful to any one who may again attempt to subdivide it, and is, in the mean time, in a physiological point of view, exceedingly curious. It is, that most of the species from the colder regions of the Himalaya mountains, correspond with the European I. *noli tangere*, in the form and dehiscence of their capsule, that is, they split from the base, rolling the segments towards

the apex, while those of the warmer regions split from the apex and roll their segments towards the base. This difference of habit between those of India proper and the Himalayan forms, is well worthy of notice, as it shows, that the affinity which exists between the flora of the latter and that of Europe, is stronger than between it and the Indian, and extends to even this most purely tropical genus.

The innate power which plants enjoy of selecting the soil and climate in different countries, however remote, most suitable to their perfect development, and which the preceding remarks have shown to be so eminently possessed by those of this order, may, when the subject has been more studied and is better understood, prove of immense benefit to the scientific cultivator.

Taking for an example the genus *Impatiens*, we may at once infer, that herbaceous plants growing where its species abounds, and arriving at maturity about the same time, may be transferred to any other locality, where they are equally prevalent. Thus the associates of I. *noli-tangere, insignis, racemosa* and *bicolor*, might be mutually interchanged; while the neighbours of I. *reticulata, puberula,* &c. might be made to change places with those of I. *fasciculata, grandis*, and many more, with every prospect of success. The limits to which this rule may be extended are as yet totally unknown, and cannot be estimated, until plants are studied not as insulated individuals, but in connexion with the soil, climate, aspect, exposure, &c. in which they are observed to arrive at the greatest perfection. This is a study which the scientific Botanist pursues in its relations to the physiological peculiarities of plants, but to the cultivator, it becomes one of much deeper and more engrossing interest, as the success or failure of vast speculations may depend on his acquaintance with, or ignorance of, the external agents which act on the objects of his culture—whether for their benefit or their injury.

Properties and Uses. Under this head there is little room for remark. One species, *Impatiens noli tangere*, which derives its name " *Noli tangere*" from its acrimony, is said to be so powerfully diuretic that it is capable of producing a diabetes. This I think may be doubted. Applied as a cataplasm on the hypogastrium, it equally acts on the kidneys. Neither this nor, I believe, any other species of the genus is now used in medicine. As however species greatly abound in India the subject, of their medical properties, seems not undeserving of enquiry among those favourably situated for conducting such investigations.

Remarks on Genera and Species. The genera of this order are few, amounting as yet, I believe, to only two, viz. *Impatiens* and *Hydrocera*—the former distinguished by the irregularity, caused by suppression and union of parts of its flowers, the latter, by having them quite regular with a drupacious 5-celled fruit —The species on the other hand, are numerous, and when characterized from dry specimens the most difficult to distinguish, though with recent ones less so than those of many other genera. This arises from the tender succulent nature of the plants causing the flowers, the part from which the best characters are derived, to become so matted together in drying, that it is quite impossible to separate them afterwards in such a manner as to show their forms.

The genus *Impatiens* affords several excellent marks for the distribution of its species into sectional groups: for example, in some the valves of the capsule roll from the base to the apex; in others from the apex to the base: this character may serve to divide them into two subgenera—*Impatiens* and *Balsamina*. Of *Balsamina* some species have *alternate*, others *opposite* leaves: these differences form the first subdivision of them. Of the alternate leaved section again, so many have axillary, solitary, one-flowered pedicels; while others have many flowered peduncles. Of the latter or opposite leaved division, the flowers are either solitary in the axils, or they are fascicled. To these leading divisions several other easily observed subdivisions can be made, which, so vastly facilitate the discrimination of the species, that those of this, generally supposed most difficult genus, become among the easiest to distinguish of those embracing so large a number.

The fullest advantage has been taken these sectional characters, in our account of the genus in the Prodromus as well as in the respective contributions towards the elucidation of its species by both Dr. Arnott and myself, published in *Hooker's Companion to the Botanical Magazine, vol. 1st,* and in the *Madras Journal of Science.* To these sources I am under the

necessity of referring, having already exceeded my space here. The species figured, is a Ceylon plant, first discovered and named by Mr. Moon: Colonel and Mrs. Walker afterwards found it, and for the figure, I am indebted to the kindness of that accomplished lady.

IMPATIENS.

§. *Leaves alternate, pedicels axillary, solitary, or aggregated, one flowered.*

I. repens, (Moon's Catal.) diffuse, procumbent, leaves alternate, suborbicular-cordate, hairy, pedicels axillary, longer than the leaves, flowers large, (yellow) upper sepals orbicular, lower cuculate ending in a thick short spur, tumid at the apex, lateral petals deeply 2-lobed, lobes irregular, the upper ones larger, ovary hairy.

In shady vegetable soil, Four Korles. Moon.

I. Munronii, (R. W.) Erect, sparingly ramous, leaves crowded towards the summit, ovate, slightly serrated, acute, hairy on b th sides, pedicels axillary, solitary, one (always?) flowered, furnished near the base with a bractea, longer than the leaves: lateral sepals ovate, toothed at the apex, posterior ones concave, helmet-shaped, and furnished with a foliaceous crest, lower one conical, terminating in a long hooked spur, lower lobes of the petals twice the size of the upper ones.

Neilgherries on moist rocks by the road side near Sispara. Munro and Gough.

The affinities of this species are clearly with my *I. auriculata* and *I. viridiflora*, but it certainly differs from both. The bractea near the base of the petiol seems to indicate that the peduncles are occasionally and perhaps often 2-flowered, when exposed to much moisture and growing luxuriantly.

§. *Leaves alternate, peduncles many flowered.*

I. Goughii, (R. W.) Erect, ramous, every where glabrous, leaves ovate, serrated, short petioled, aggregated towards the summit of the branches, peduncles filiform, axillary, umbellately, 4-6 flowered, often three or four times the length of the leaf, viscid, flowers small, lateral sepals minute, subulate, superior ones broad, obcordate mucronate, lower, much shorter than the petals, acute, spur shorter than the flowers, conical, slightly incurved—anterior lobes of the petals much larger than the posterior, capsules glabrous.

Neilgherries on damp rocks by Pekarra river. Gough.

The present species is evidently intermediate between *I. uncinata* and *I. campanulata*, having a shorter spur than the former, and longer than the latter, but judging from the specimens is much smaller than either. This however is a mark of no value, as the same species in some situations may be quite diminutive, while in others it attains a great size.

I have dedicated these the only new species yet received from the Hills to the two young Botanists who, in company, explored much of them that had not previously been examined.

EXPLANATION OF PLATE 61.

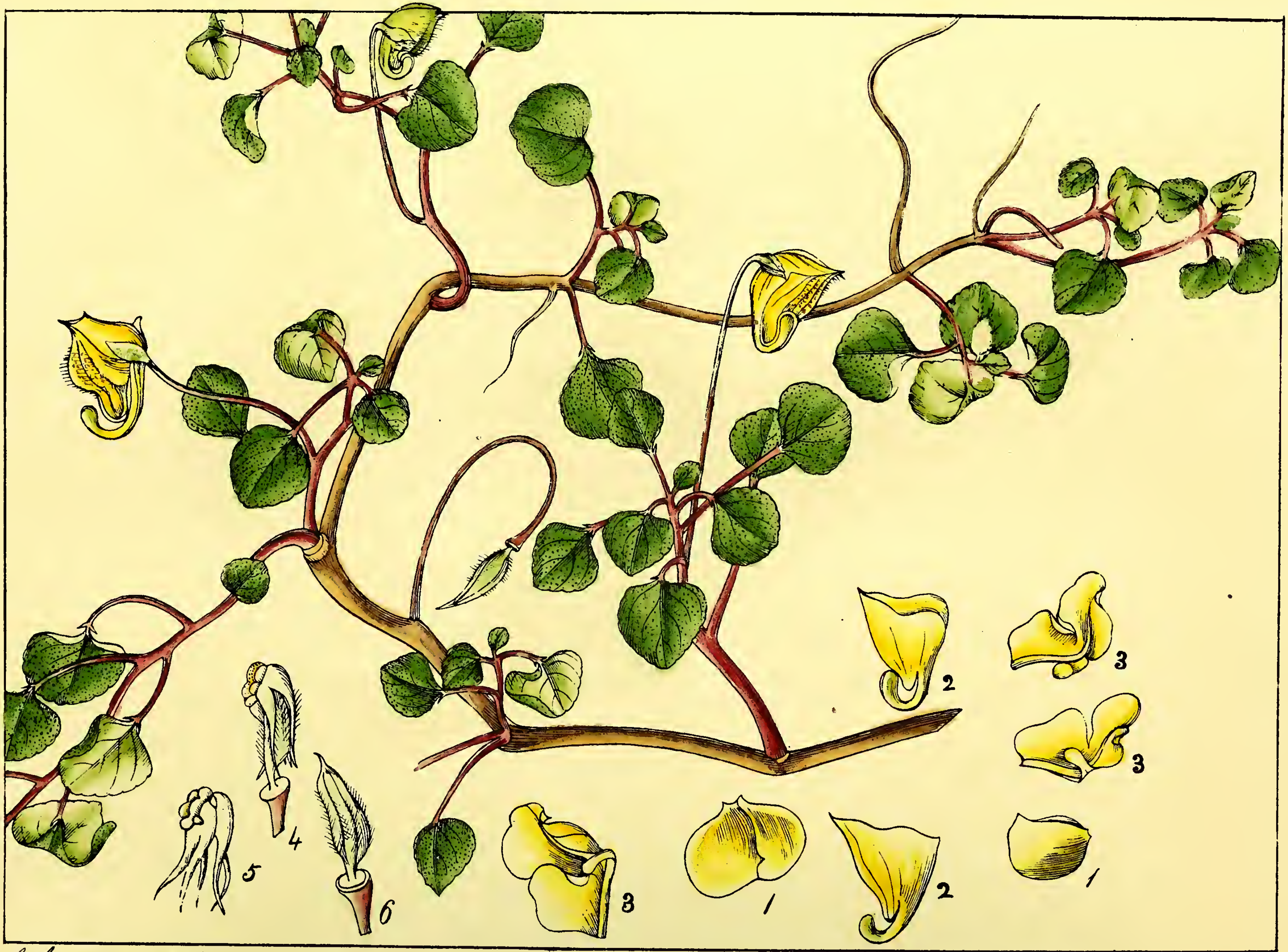
1. Upper sepal front and side views.
2-2. Anterior sepal with its spur.
3-3-3. Petals different views.
4. Ovary and stamens.
5. Stamens removed.
6. Ovary and style.

XLV.—OXALIDEÆ.

This is the last of the Indian group of families which appertain to the class *Geranioideæ*, a group the members of which, when superficially viewed, seem to be most heterogynious and ill assorted, but which, when more closely scrutinized are found connected in so many important points and to glide into each other by such insensible gradations, that it becomes difficult to find good ordinal characters by which to keep them distinct. The whole are marked by the predominance of the quinary proportion of parts, 5 sepals and petals; 5-10 rarely 15, usually monadelphous, stamens; 5 styles, and 5 cells to the ovary, with usually few superposed ovules; 5 membranaceous 2-valved carpels, cohering round a central persistent column; exarillate, and with the exception of *Oxalideæ*, exalbuminous seed. Thus intimately united, the ordinal characters are taken from peculiarities of less importance, but yet of so obvious a character that it seems well to preserve the distinctions which have been introduced and found useful in practice.

This order though abounding in species has but few (3) genera, and these, with the exception of *Oxalis* have exceedingly few species, 154, out of 158 enumerated by DeCandolle in the order, belonging to that genus. Some additions have since been made but I believe very few. They most abound in America and the Cape of Good Hope. In India the species are few, but present a great contrast in their forms—two out of about 6 or 8 Indian species being considerable trees, while all the rest are small herbaceous plants, mere weeds.

" Sepals 5, equal, sometimes cohering at the base, persistent; æstivation imbricative. Petals 5, hypogynous, equal, unguiculate: æstivation twisted. Stamens 10, hypogynous, more or less monadelphous: those opposite the petals longer than the others: anthers erect, bilocular. Ovarium 5-angled, 5-celled: ovules solitary, or several in each cell: styles 5, filiform: stigmas capitate, or slightly bifid. Placentæ in the axis. Fruit rarely baccate: usually capsular, membranous, 5-celled, and 5-10 valved. Seeds 1, or several in each cell: testa fleshy,



Gab-demata-Sing)

IMPATIENS REPENS. MOON.

bursting elastically. Albumen between cartilaginous and fleshy. Embryo straight, as long as the albumen: radicle long; next the hilum: cotyledons foliaceous.—Leaves compound (or by abortion simple), alternate, seldom opposite or whorled."

Affinities. The affinity of this with the three preceding orders, has been already adverted to. Formerly it was united with *Geraniaceæ*, and is still considered by some not sufficiently distinct. DeCandolle however thinks it more nearly allied to *Zygophylleæ*, though quite distinct. Its compound leaves and albuminous seed in both of which respects it differs from *Geraniaceæ* but associates with *Zygophylleæ*, seem to confirm this view.

Geographical Distribution. The genus *Oxalis* is principally confined to the Cape of Good Hope and America, but is also though sparingly met with in Europe, Asia, and New Holland. The genus *Averhoa* is confined to India and the adjoining islands: of *Biophytum* one species is found in the West Indies and the rest in India.

Properties and Uses. Acidity is the predominating quality of this order. The *Oxalis acetosella* or wood sorrel, is well known in Europe, and esteemed on account of its cooling and refreshing properties, the expressed juice of which furnishes, when crystalized, the so-called essential salt of Lemons, or binoxalate of potash. Both species of *Averhoa*, namely, *A. Carambola* and *A. Bilimbi*, are equally well known on account of their intense acidity. The kind of acid which imparts the taste I have never seen mentioned, but presume it is oxalic, the one which predominates in the family. The fruit of the former is considered cooling and aperient.

Remarks on Genera and Species. Originally two genera only were referred to this family, *Oxalis* and *Averhoa*. The former of these DeCandolle split into two, more perhaps, on account of the marked difference of habit than from any well marked differences of structure. The principal points of difference consist in the filaments, being free to the base in the one (*Biophytum*) while they are united into a tube nearly half their length in the other (*Oxalis*). They also differ in the form of their fruit, the former having its capsules approaching to globose, while in the latter they are cylindrical. These distinctions, added to the very marked difference of habit have induced me to revert to DeCandolle's division, from which we departed in the Prodromus. The species of the genus *Biophytum* are of difficult discrimination, and it has been doubted whether there are more than one in India—on this point I now feel quite satisfied, and think we may certainly acknowledge two, I think several species. Supposing we fix upon the former number there can be no difficulty in distinguishing them, the one being marked by having a single terminal tuft of leaves on a more or less elongated simple unbranched palm-like stem—the other, by having a diffuse ramous proliferous stem, each branch terminating in a tuft of leaves. The various forms might then be ranged under these, as so many varieties. The difference of habit and station which some of these forms affect seem to stand in opposition to this extent of simplification, for example—*Biophytum sensitivum* is only found on the plains usually in very open ground exposed to the full blaze of the sun's light, whereas, the form figured in plate 62 is only found in cool alpine situations under the shade of thick jungles, both here and in Ceylon. These circumstances may induce the belief that the plant is the same, only altered by local circumstances, an opinion which, if urged, I confess I have not the means of controverting, since it can only be set aside by making the two plants change places, and in that way determining whether or not their forms would alter also. The *B. sensitivum* is further distinguished by being glabrous, while the other is very generally clothed with hairs, sometimes, especially on the rachis of the leaves and peduncles, very densely. This character, however, is not sufficiently constant in either form to admit of much weight being attached to it. Of the palm-like forms there are again two varieties distinguishable by the form of their leaflets—the form fig. 8 in plate 62 represents the one, that of fig. 10 nearly corresponds with the other, though not taken from it—fig. 8 is a slightly magnified leaflet of *B. Candolianum*—fig. 10 is that of a species to be afterwards mentioned, but, with the exception of its being a little more tapering and less distinctly mucronate at the point, gives a pretty good idea of the form of Dr. Arnott's *B.* (Oxalis) *nudum*, and will assist in distinguishing these two perhaps too nearly allied species.

Of the proliferous division, the forms are more numerous and less easily distinguished, but may perhaps be reduced to three, distinguished by the form and relative number of leaflets—1st. *B.* (Oxalis) *proliferum* (Arn.) leaves and leaflets small, 8-14 pairs, rachis (mid-rib of the whole leaf) about 1 inch or $1\frac{1}{2}$ inch in length —*Ceylon, in woods*—2d. *B. intermedium* (R. W.) leaflets much larger, 14-20 pairs: rachis from 2 to 4 inches long.—*Ceylon and Courtallum, shady woods.* The leaflets of this are as large as those of *B. Candolianum*—3d. *B. polyphyllum* (Mun: MSS.) leaflets from 30 to 40 pairs, minute, attenuated towards the apex, bristle pointed, (tab. 62, fig. 10) rachis from $2\frac{1}{2}$ to 3 inches in length.—*Neilgherries*—Messrs. Munro and Gough. There is yet a fourth form of this division, which may be called *B. verticellatum,* in which the tufts of leaves in place of terminating the branches form verticels round the very diffuse slender stems.—*Courtallum in very dense thickets.* The foliage of this form is intermediate between *B. polyphyllum* and *intermedium,* having the small obliquely pointed hairy leaflets of the former, and the smaller number of pairs, 20 to 30, of the latter.

Of these different forms I shall make it my endeavour to publish figures in my Icones, leaving the question whether they are species or varieties still undecided for future observers to investigate.

EXPLANATION OF PLATE 62.

1. Byophitum Candolianum, (R. W.) *natural size.*
2. Calyx, ovary, styles and stamens.
3. Corolla, the petals partially cohering.
4. Shorter stamens, back and front views.
5. One of the longer stamens with its attached scale.
6. Ovary divided vertically.
7. —— —— transversely, 5-celled.
8. Leaflets of B. Candolianum.
9. —— —— B. sensitivum.
10. ——— B. polyphyllum.

XLVI.—CONNARACEÆ.

Much difference of opinion seems to exist among Botanists as to the place in the series of orders this one ought to occupy. Jussieu placed the genus *Connarus* among the *Terebinthaceæ,* DeCandolle retains it and the other genera composing order in the same family, forming of them his tribe *Connaraceæ.* Brown first proposed its separation as a distinct family, in which he has been followed by most modern writers, who generally retain it among the perigynous orders placing it between *Terebinthaceæ* and *Leguminoseæ,* to some of the extreme forms of the latter of which orders, the character of its fruit nearly allies it. Dr. Brown however states it as his belief, in which I perfectly coincide, that the insertion of the floral appendages is hypogynous and not perigynous.

This opinion of the highest living Botanical authority, further confirmed by personal examination, induced Dr. Arnott, contrary to the general practice, to bring it here. The propriety of this arrangement there seems, at first sight, some reason to question, but it derives so much support from the hypogynous insertion of the stamens, and the 5-celled ovaries, on a gynobase, of *Rouria* and *Cnestis,* in both of which respects they so closely approach *Zanthoxylaceæ,* as scarcely to leave a doubt of the propriety of the change, notwithstanding the 1-celled ovary of *Connarus.*

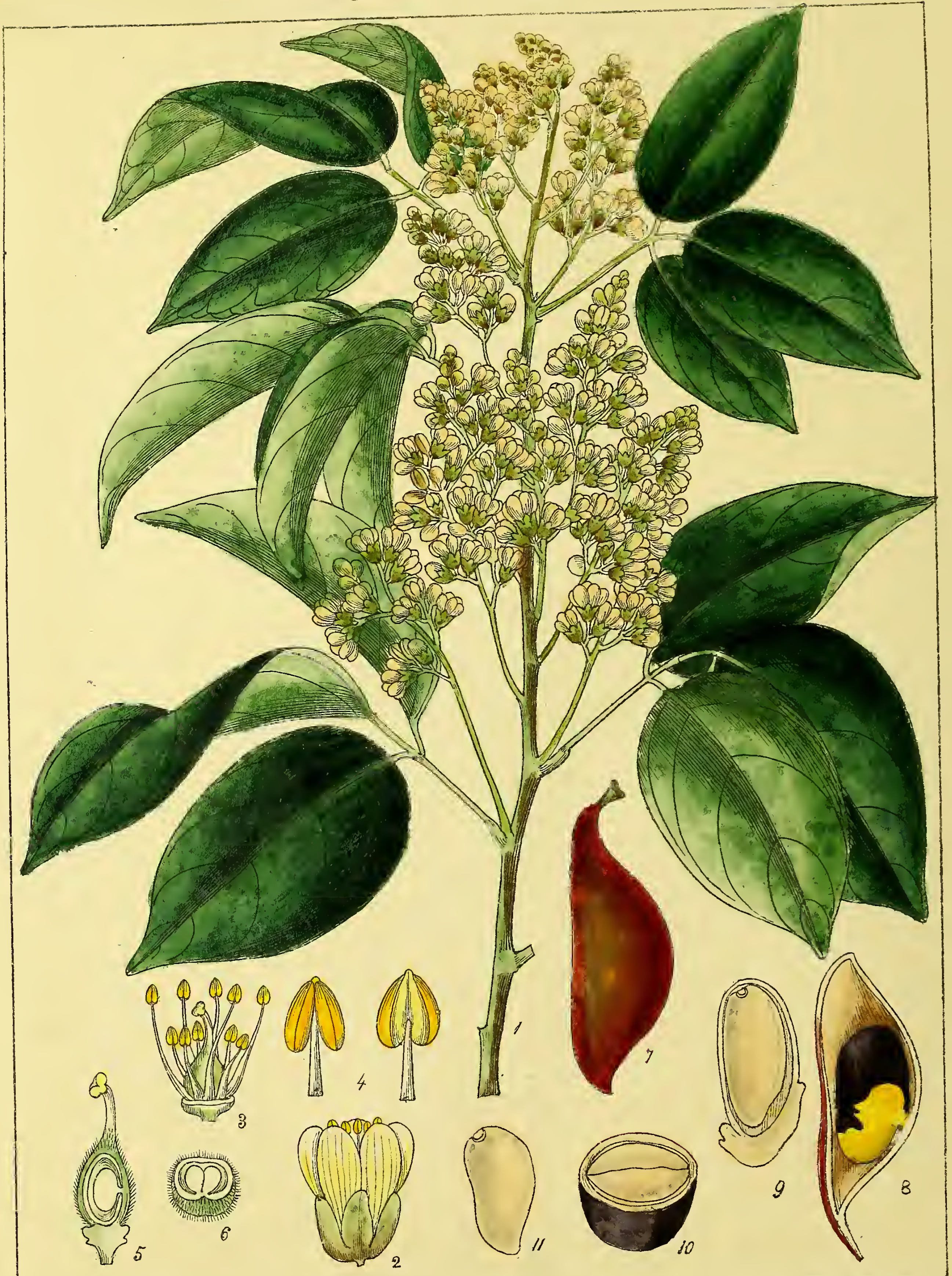
The following amended character was drawn up by Dr. Arnott for our Prodromus.

"Flowers bi- (rarely uni) sexual. Calyx 5-partite, regular, persistent, æstivation imbricate or valvular. Petals 5, equal, inserted into the base of the calyx. Stamens twice as many as the petals, rarely with half of them sterile, hypogynous: filaments usually combined at their base into a glandular ring. Ovaria simple and solitary, or several and distinct: ovules in pairs, collateral, ascending: styles terminal, continuous with the central angle of the carpels: stigmas obtuse, usually dilated. Capsules 1-5, dehiscing longitudinally at the ventral suture. Seeds solitary, erect, sometimes with an arillus. Albumen none, or fleshy. Radicle superior, at the opposite extremity from the hilum: cotyledons thick when there is no albumen, foliaceous in those with it.—Trees or shrubs without resinous juices. Leaves compound, alternate, not dotted, exstipulate."

Affinities. The affinities have been indicated above so far as they are known, but still there is some room to doubt whether they are yet well understood—on which account I will not occupy further space in the discussion of this question.

தொட்டாவாடி
Tottal Vady }

BIOPHYTUM CANDOLIANUM.(R.W.)



Rungia. del

Winchister Lith

CONNARUS PINNATUS (*Lam*)

Perim Curegil, malal

Hort. mal 6 tal 24

GEOGRAPHICAL DISTRIBUTION. The members of this order are all natives of the tropics, and are met with in Asia, Africa and America, but no where numerous. In India they have a wide range, extending from the southern extremity of Ceylon and the Peninsula, up to Silhet.

In Malabar, towards the extreme south two or three species are very abundant. In other parts of the continent, I have visited, they are comparatively unknown.

PROPERTIES AND USES. I am not aware of any uses to which these plants have been applied, some of them form handsome flowering shrubs and are not less interesting in appearance when in fruit than when in flower, the numerous bright-red capsules contrasting favourably with the deep green of the leaves long after the flowers have disappeared. Under cultivation, they might succeed here, and would form a showy addition to the ornamental shrubbery.

REMARKS ON GENERA AND SPECIES. The Peninsular flora only presents us with two genera of this order, *Connarus* and *Rouria*. These are most easily distinguished by the ovary, which in the former is solitary, and 1-celled; while in the latter, there are 4 or 5, each having its own style and stigma. In the character of the flowers *Rouria* and *Cnestis* are very closely allied, each having five ovaries, but the latter has albuminous seed, which is wanting in the former. Adopting these simple distinctions the perplexity existing among the genera and species of this order is at once removed, by the reduction of the heteromorphous genus *Omphalobium*, at present made up of species taken from each of these, and the restoration of Aublet's prior genus. The certain genera of this order then amount to three, *Connarus, Rouria,* and *Cnestis,* species of each of which are found in India.

EXPLANATION OF PLATE 63.

1. Connarus pinnatus—*natural size.*
2. A flower showing the sepals and petals.
3. The same, the sepals and petals removed to show the ovary and stamens.
4. Anthers back and front views.
5. Ovary cut vertically, showing the lateral insertion of the ovules.
6. ——— transversely, showing the ovules paired and collateral.
7. A mature capsule.
8. The same opened to show the seed *in situ.*
9. The seed divided longitudinally, showing the radicle superior or at the opposite end of the seed from the hilum.
10. A seed cut transversely.
11. A seed lobe, the testa removed.

XLVII.—ZYOPHYLLEÆ.

This is a small order of tropical plants of which the Indian peninsula only presents two species, but referable to different genera, both mere weeds. In America however, some of the species, among which is the *Guaiacum* or *Lignum vitæ,* attain a great size and afford very fine close-grained timber. The absence or presence of albumen in the seed seems in this order to be of small account, since in our two genera one (*Fagonia*) has it, and the other (*Tribulus*) is without.

" Flowers bisexual, regular. Calyx 4-5 divided. Petals unguiculate, alternate with the sepals: æstivation usually convolute. Stamens twice as many as the petals, hypogynous: filaments distinct, dilated at the base, and usually arising each from the back of a scale: anthers 2-celled, opening longitudinally. Ovarium simple, more or less 4-5 furrowed, 4-5 celled: ovules in pairs or more, pendulous, or rarely erect: style simple, often 4-5 furrowed: stigma simple, or 4-5 lobed. Fruit capsular, or rarely fleshy, with 4-5 angles or wings, 4-5 valved and loculicidal, or indehiscent: endocarp and sarcocarp combined. Seeds usually fewer than the ovules. Albumen between fleshy and horny, rarely 0. Embryo green: radicle superior: cotyledons foliaceous.—Leaves opposite, stipuled, not dotted, rarely simple."

AFFINITIES. Most Botanists agree in considering them nearly allied to *Rutaceæ,* from which however they are readily distinguished by the want of pellucid dots in the leaves, which are always present in the other. They are also allied to *Oxalideæ* between which orders DeCandolle places them, separating them from the latter by their single not several styles, by their stipulate opposite leaves, and by their seed not having an arillus. This last mark is of less

value as it does not seem constant in *Oxalideæ*. From the former, in addition to the absence of pellucid dots, theydiffer in wanting the elastic structure of the carpels so remarkable in the true *Ru aceæ*.

Geographical Distribution. Species of this family are found in every quarter of the globe Europe, Africa, Asia, America, and New Holland. *Fagonia* and *Tribulus* are both found in the south of Europe as well as in India. The former abounds in the Ceded Districts and also in Mysore, but I have never seen it in the Carnatic, the latter, *Tribulus*, is one of the most common weeds all over India, and a very troublesome one, owing to the thorns with which its carpels are armed.

Properties and Uses. The roots and leaves of *Tribulus* are said by native practitioners to be diuretic, the latter are used by the natives as a pot herb and are esteemed very cooling in particular states of the system. Of the American species the *Guaiac* is the most important and is still much used in medicine. The *Zygophyllum Fabago* is occasionally used as an anthelmintic.

Remarks on Genera and Species. In so far as Indian Botany is concerned there is but little room for remark on this head. I may however observe that the numerous varieties which the Indian plants present seem to afford strong ground for doubting whether all the species referred to each of the two genera are tenable. Our *Tribulus* for example has the leaves with from 3 to 8 pairs of leaflets, the carpels with two or four spines often on the same plant, and every degree of clothing from nearly glabrous to densely tomentose, I thence infer that both *T. terrestris* and *T. lanugenosa* are identical, and probably several others may be reduced to that species. *Fagonia Mysorensis* is characterized as having simple not trifolialate leaves. The accompanying figure will show how erroneous that is, and I doubt not the same will be found in several of the others and prove that they all form but one species.

EXPLANATION OF PLATE 64.

1. Fagonia mysorensis—*natural size.*
2. A flower.
3. The same, petals removed and sepals forcibly opened to show the insertions of the stamens and the ovary *in situ*.
4. Stamens back and front views.
5. Ovary cut vertically, ovules erect.
6. ——— transversely, 5-celled, each cell or carpel attached to a central gynophore.
7. A fruit—*natural size.*
8. The same cut transversely.
9. A seed.
10. Divided lengthwise, to show the embryo seated in the base of the large albumen.
11. Embryo removed—*with the exceptions mentioned, all more or less magnified.*

XLVIII.—RUTACEÆ.

In Indian Botany this is a very unimportant order, three species only having as yet been found in the Peninsula, and one at least of these, *Ruta angustifolia*, a doubtful native. Of the section *Diosmeæ*, by for the larger of the two into which it is divided, only one species *Dictamnus Himalayanus*, has been found in all India and that confined to the Himalayas. *Cyminosma* is the only genus of *Rutaceae* which I have found unequivocally native, and it is a very abundant tree in subalpine jungles all over the country.

" Flowers bisexual, regular. Calyx 4-5 divided. Petals alternate with the sepals: æstivation between twisted and convolute, rarely valvular. Stamens twice or rarely thrice as many as the petals, inserted round the base of the torus: anthers 2-celled, opening longitudinally. Torus various, discoid, or elevated, or cup-shaped. Ovary usually more or less deeply 3-5 partite, 3-5 celled: ovules in each cell 2-4, or 6 12, or numerous, pendulous, or partly pendulous, or adnate to the placentas: styles combined, or in the deeply lobed ovaries distinct at the base and combined upwards: stigma 3-5 angled or furrowed. Capsule usually 4-5 lobed, the lobes opening internally at the apex: rarely 3-valved and loculicide, or a 4-celled drupe:

Rungia. del *Winchester. Lith*

FAGONIA MYSORENSIS (*Roth*)

[illegible] Mal:
Bêenel. Lat:

CYMINOSMA PEDUNCULATA. (DC)

[illegible] Arav:

sarcocarp and endocarp combined. Seeds by abortion, often fewer than the ovules, pendulous or adnate. Embryo contained in the fleshy albumen: radicle superior: cotyledons flat.—Leaves exstipulate (except in *Peganum*), alternate (except in *Cyminosma*), simple, or deeply lobed, or rarely pinnated, usually with pellucid dots."

Affinities. This order is so nearly allied to those among which it is placed that most Botanists consider them all as forming either a class or one order divisible into so many suborders. These are *Zygophylleae, Ruteae, Diosmeae, Zanthoxylleae,* and *Simarubeae,* to which perhaps *Connaraceae* and *Ochnaceae* might be added as both possess the gynobasic structure and other characters associating them with this group or alliance, though differing in many others which it is necessary to take into account in determining affinities.

Geographical Distribution. Every quarter of the globe boasts of members of this family. Europe has species of *Peganum Ruta* and *Aplophyllum.* India has, in addition to these, *Cyminosma,* all referable to the first section *Ruteae:* while to the 2d section, *Diosmeae,* a species of *Dictamnus* is found in each.

The *Diosmeae* abound about the Cape of Good Hope, in South America, and in New Holland. Most of these being handsome flowering shrubs some of them might be advantageously introduced into India, as the climates of which they are natives sufficiently accords with that of this country to hold out the prospect of success in any such attempt.

Properties and Uses. Bitterness and a strong heavy odour are the prominent peculiarities of most of the species of this order. In Europe the common rue is employed, but now only to a limited extent, in medicine. The *Diosmas* or *Bucka* plants of the Cape are well known on account of their very offensive smell: they are used there as Antispasmodics. Some of the American species are esteemed very powerful febrifuges, especially the *Angustura bark,* the produce of *Cusparia febrifuga,* one of the *Diosmeae.* There are several other American species celebrated for the possession of similar properties, but to which it is useless to allude here where they are quite unknown.

Remarks on Genera and Species. Under this head I have nothing to offer as I only know three or four species, and none of them call any remark.

EXPLANATION OF PLATE 65.

1. Cyminosma pedunculata—*natural size.*
2. An expanded flower.
3. A petal.
4. Stamens.
5. Ovary cut vertically.
6. ——— transversely.
7. A fruit not quite mature—*natural size.*
8. ——— cut transversely, to show its 4 cells.
9. A seed—*natural size.*
10. The same.
11. Testa removed.
12. Cut longitudinally, showing the embryo and albumen *in situ.*
13. Embryo removed, foliaceous—*all, with the exceptions mentioned, more or less magnified.*

XLIX.—XANTHOXYLACEÆ.

As stated above, this is viewed by most Botanists as merely a section or suborder of *Rutaceae,* but is certainly an interesting one, including many genera, yet all so intimately united that it becomes exceedingly difficult to determine their limits. Though in a great measure of tropical origin the Peninsular flora embraces but few representatives, our list in the Prodromus only extending, including *Ailanthus,* to seven species ranged under three genera, namely, *Xanthoxylum, Toddalia* and *Ailanthus,* Mergui and Malacca have *Brucea* in addition. One additional genus may however be required for the Peninsular species. Generally the species are either trees or shrubs, sometimes scandent, frequently armed with strong prickles, having, usually, compound leaves pierced with numerous transparent oily glands, like those of *Aurantiaceae,* and numerous aggregated small, generally, unisexual flowers: that is, male flowers furnished

with perfect stamens and the rudiments only of an ovary, or with a perfect ovary and imperfect stamens. *Ailantheae* are usually united with these as a mere tribe, Dr. Arnott in my opinion more judiciously forms of them a suborder, an arrangement, which I adopt here, but for the purpose of exhibiting both views I subjoin in his own words Meisner's characters of these tribes* as given "*in aureo Cl. Meisneri libro cui titulus: Plantarum Vascularium Genera tabulis diagnosticis exposita*" a work well meriting the brief but forcible encomium thus bestowed by the celebrated DeCandolle, himself, the author of the noblest Botanical work that has yet issued from the press, a monument of the most untiring industry, and most profound research.

"Flowers by abortion unisexual, regular. Calyx 3-4-5 divided. Petals equal in number (rarely more) to the sepals: æstivation usually twisted, convolute. Stamens as many, or twice as many, as the petals, inserted round the base of the torus. Torus elevated and forming a gynophore or short thick stalk to the pistillum, which, in the male flowers, is rudimentary or rarely entirely absent. Carpels usually as many as the petals, sometimes fewer, seated on the gynophore, sometimes combined into one ovary, sometimes entirely or partially distinct: ovules 2, or rarely 4, in each carpel: styles in the single ovaries combined, in the distinct ovaries either distinct or combined upwards, sometimes none: stigma 2-5 lobed in the united styles, simple in the distinct styles. Fruit sometimes single, baccate or membranaceous, 2-5 celled: sometimes of 1-5 distinct drupes or 2-valved capsules, of which the sarcocarp is either entirely combined with, or only partially separable from, the endocarp. Seeds solitary or in pairs, pendulous. Embryo lying within a fleshy albumen: radicle superior: cotyledons oval, flat.—Leaves exstipulate, alternate or opposite, with pellucid dots or rarely without them."

AFFINITIES. These are so complex that I abstain from attempting to elucidate them myself, and therefore have course to the far abler exposition given by the younger Jussieu, and reprinted in Lindley's Natural System of Botany, merely observing, that I am not disposed to lay so much stress on characters taken from the absence or presence of albumen in the seed, since every day's observation tends to convince me that characters taken from it require to be used with caution, as I think our knowledge of vegetable structure, in connection with the absence or presence of this substance in the seed is not sufficiently advanced to enable us to

Tribus I. XANTHOXYLEÆ—ARN.

* Genuinæ: *florib-diclinib.* (rarissime hermaphrod. cfr Picrasma).

A. Discus elevatus, gynophorum breve crassum formans. Ovaria in fl. ♂ rudimentaria, rarissime O, in fl. ♀ plus minus inter se coalita, rarius distincta rarissime (v. Blackburnia) unicum, singula 2-rarius 4-ovulata. Stigmata distincta simplicia, aut in unicum 2-5-lobum connata. Carpella 1-5 distincta aut coalita, nunc indehiscentia drupacea, nunc capsularia 2-valvia. Albumen carnosum. Embryo sæpius curvatus. (Folia nonnunquam opposita, plerumque pellucido-punctata.)

Tribus II. AILANTHEÆ—ARN.

Discus depressus aut cupulæformis, 4 lobus. Ovaria plura, distincta, 1-ovulata. Stigm. distincta. Carpella 3-5, distincta, indehisc., drupacea aut samaroidea. Albumen ? tenue, carnosum, seminis integumento adhærens. Embryo rectus. (Folia alterna, impunctata. Flor. sæpe polygami.)

XANTHOXYLUM. (L.) KTH.

I Ovula juxtaposita. Cal. 4-5-part. Pet. 4-5, rarissime O. ♀: Stam. sterilia squamiformia, ananthera aut anth. effoetas gerèntia, aut O. Ovaria 5-1. Styli liberi aut apice connati, interdum subnulli. Stigmata libera capitata, aut inter se cohærentia demum solubilia, aut (sicut styli) in unicum 4-5 lobum connata. Caps. 5-1, sessil. V. stipitatæ, distinctæ, rarius intus connatæ, 2-1-spermæ. (Arb. V. frut., sæpe aculeat. Fol. simpl. V. compos. pell.-punct. Inflor. varia.—*Patria extra Europ. diffusa, præcipue intra trop.*

* *Flores apetali,* partium numero quinario. Sepala petaloidea (ex Kunth interdum 6-9). Styli stigmate clavato conjuncti, basi distincti .... } *Xanthoxylon. Colden.*

** —— *Completi.*

A.—*Partium numerus ternarius.* Cal. 3-dent. Pet. 3. Germ. 3-part. Styli 3, filiform. Carpella 3, 1-spenna.—(Ins. Antill.).. } *Tobinia Desv.*

B. —— —— *quaternarius.*

1) Ovaria 2........ *Pterota. P. Brown.*

2) —— 4. Styli 4, stigmatib. Capitellatis inter se cohærentes........ } *Aubertia. Bory. S. Vinc.*

C. —— —— *quinarius.* Cal. 5-part. Pet. 5. Stam. 5........

1) Ovaria 3-5........ *Ochroxylum. Schreb.*

2) —— 1........ *Langsdorfia. Leand.*

draw useful characters from it. Of the genus *Zanthoxylon* for example, in all the species I have examined, 4 in number, the cotyledons are large with the albumen, if indeed such it be, reduced to a mere membranous covering. In *Toddalia bilocularis* it is altogether wanting. True these may, and perhaps ought to be removed from the genera to which they are referred on that very account, but the fact of its absence in some and presence in others, shows how valueless it is an ordinal character in this tribe, and is still further shown by what is observed in *Ruteæ* and *Diosmeæ,* which, though so nearly related, are yet distinguished by the one tribe having albumen, the other being exalbuminous. Having premised these few remarks on this point of structure, I shall proceed with the extract.

"This is one of the families which comprehend genera with both distinct and concrete carpella; the latter are often entirely distinct, even in the ovarium, but more frequently there is a union, or at least a cohesion, of the styles, by which their tendency to concretion may be recognized. In a few instances the carpella are absolutely solitary.

"The place originally assigned, and for a long time preserved, for most of the genera of *Zanthoxyleae,* proves sufficiently how near the affinity is between them and *Terebinthaceae.* If, with Messrs. Brown and Kunth, the latter are divided into several orders, *Zanthoxyleae* will be most immediately allied to *Burseraceae* and *Connaraceae,* agreeing with the former in the genera with a simple fruit, and with the latter in those with a compound one. Notwithstanding the distance which usually intervenes in classifications between *Aurantiaceae* and *Terebinthaceae,* there are nevertheless many points of resemblance between them; Correa has pointed out a passage from one to the other through *Cookia,* Kunth, in new-modelling the genus *Amyris,* and in considering it the type of a distinct order, suspects its near affinity with *Aurantiaceae;* we cannot therefore, be surprised at the existence also of relations between the latter and *Zanthoxyleae.* A mixture of bitter and aromatic principles, the presence of receptacles of oil that are scattered over every part, which give a pellucid dotted appearance to the leaves, and which cover the rind of the fruit with opaque spaces,—all these characters give the two families a considerable degree of analogy. This has already been indicated by M. de Jussieu in speaking of *Toddalia,* and in his remarks upon the families of *Aurantiaceae* and *Terebinthaceae;* and it is confirmed by the continual mixture, in all large herbaria, of unexamined plants of *Terebinthaceae, Zanthoxyleae,* and *Aurantiaceae.* The fruit of the latter is, however, extremely different; their seeds resembling, as they do, *Terebinthaceae,* are on that very account at variance with *Zanthoxyleae,* but at the same time establish a further point of affinity between them and some *Rutaceous* plants which are destitute of albumen. Unisexual flowers, fruit separating into distinct cocci, seeds solitary or twin in these cocci, enclosing a usually smooth and blackish integument, which is even sometimes hollowed out on its inner edge, a fleshy albumen surrounding an embryo the radicle of which is superior, are all points of analogy between *Zanthoxyleae* and *Euphorbiaceae,* particularly between those which have in their male flowers from 4 to 8 stamens inserted round the rudiment of a pistil, and in the female flowers cells with 2 suspended, usually collateral, ovules. Finally, several *Zanthoxyleous* plants have in their habit, and especially in their foliage, a marked resemblance to the ash. The diœcious flowers of *Fraximus,* its ovarium, the two cells of which are compressed, having a single style, 2 ovules in the inside, and scales on the outside, and which finally changes into a samara which is 1-celled and 1-seeded by abortion, all establish certain points of contact between *Ptelea* and *Fraximus.*" *Adde Juss.*

Geographical Distribution. The greatest number of the plants of this order are found in tropical America, a few are natives of Africa: two of which, *Zanthoxylon Senegalense* and *Z. Leprieurii* resembling our *Z. Rhetsa,* are from *Senegambia.* On continental India the number hitherto discovered is not great: they appear more numerous in the Islands to the eastward. Blume, including *Rutea,* has from Java 14 species, while Roxburgh has for India only seven, Wallich's list has about 28 for all India. The Peninsular flora at the time of our publication only presented a catalogue of 10 species for the whole order *Rutaceæ,* but for *Zanthoxyleæ* excluding *Ruteæ* and *Ailantheæ* only 5, one of which is since excluded, and the genus of another still doubtful. In addition to the species described in the Prodromus, I have since found *Zanthoxylon* (Fagara, Roxb.) *triphyllum* and two new species referable to the subgenus *Langsdorfia,* also *Toddalia floribunda,* Wallich, thus adding four species to our list which now exceeds Roxburgh's.

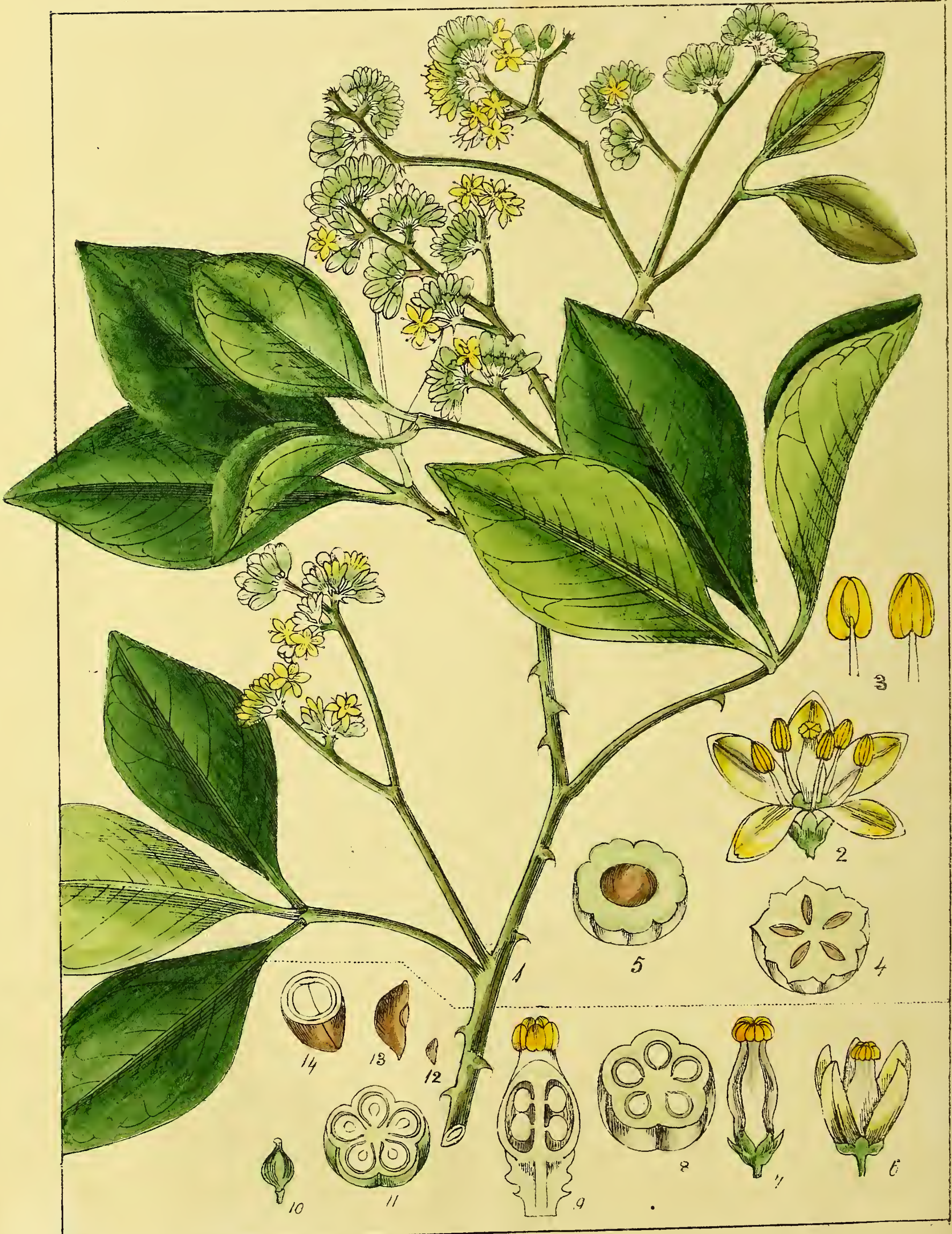
Properties and Uses. Bitter stimulating and aromatic properties pervade in greater or less intensity, almost every species of the order, at least so far as our acquaintance with them yet extends. Some species are remarkable for their tonic properties, others are powerful sudorifics, and when applied to the gums or even taken internally act as powerful sialogogues.

These properties point them out as suitable remedies for Rheumatism, in which complaint they have been found very useful. *Z. alatum* of Roxburgh, a Nepaul plant, is aromatic and pungent, and the seeds are used medicinally by the natives. Another species, *Z. piperitum,* a native of Japan, but now cultivated in India, is a powerful aromatic and used in its native country in place of pepper. It is also used as rubifacient and discutient by the natives, being applied in form of a poultice to the neighbourhood of inflamed parts. The seeds of *Z. Budrunga,* (Roxb.) have the fragrance of Lemon peel, and being of a warm spicy nature are used medicinally by the natives of Silhet, where it is indigenous. The unripe capsules *Z. Rhetsa* are like small berries and are gratefully aromatic, tasting like the peel of a fresh orange. " The ripe seed taste exactly like black pepper but weaker, from this circumstance I conceive this may be *F. perperita,* yet I have always found the leaflets entire" (Roxb.) The inner lamina of the bark is also acrid and bitter. Of *Toddalia aculeata,* a very common plant in this country, Roxburgh remarks Fl. Ind. 1 page 617—" Every part of this shrub has a strong pungent taste. The roots when fresh cut smell particularly so. The fresh leaves are eaten raw for pains in the bowels; the ripe berries are fully as pungent as black pepper, and with nearly the same kind of pungency; they are pickled by the natives, and a most excellent one they make.

" The fresh bark of the root is administered by the Telinga physicians for the cure of that sort of remittent, commonly called the hill fever. I conceive every part of this plant to be possessed of strong, stimulating powers, and have no doubt but under proper management it might prove a valuable medicine where stimulants are required."

Remarks on Genera and Species. The number of genera of this suborder is not considerable, amounting in all, according to Lindley, to 15, including *Ailantheæ.* Of these *Zanthoxylon* seems to have been the most troublesome to Botanists, there being no fewer than seven generic names ranged under it as synonyms—whether all these ought to be reduced I am not prepared to say, but, judging from what I have seen in examining the few species in my collection, I suspect some at least of these will be restored, or if they are not, then, on the same principle, I think many genera which now encumber the Botanical system might be similarly reduced.

For the purpose of facilitating the investigation of this polymorphous genus I have added to the proceeding extract from Meissner's work the characters of the subgenera of *Zanthoxylon.* Comprehensive however as the character of this genus is our *Z. cannarioides* must be removed. In it there are 5 sepals, 5 petals, 10 stamens, alternately longer and shorter, the filaments united, forming a tube, hairy within, enclosing the style, and large stigma, inserted, with the petals, outside of a large cup-shaped disk in which the 2-celled ovary is immersed, seed exalbuminous, with the radicle next the hilum. These peculiarities of the flower combined with the exalbuminous seed afford ample reasons for its separation, not only from the genus but from the order: in a word, it is a species of *Heynea.* Our *Toddalia bilocularis* must also, I fear, be equally removed from that genus, at least, if the absence of albumen, or its presence in a very unusual form, can be received as a character of sufficient weight, when aided by the difference of structure of the seed itself. The flowers however are still unknown, and unless they assisted in distinguishing this as a distinct genus, I should hesitate in removing it from the place it now occupies on account the peculiarities of the fruit only. Besides wanting albumen, the seed are remarkable for the extreme inequality of their cotyledons, the one, being three or four times larger than the other, I have not yet found flowers but judging from the seed, I should suppose it more nearly allied to *Aurantiaceæ* than *Zanthoxylaceæ,* and certainly forms an additional link between these in many other respects allied orders. Between *Evodia,* Blume, and *Fagara,* Roxburgh, there appears to be no difference, and indeed between *Evodia,* Juss. and *Zanthoxylon,* (subgenus *Aubertia*) the only difference seems to be in the declinous flowers of the latter. This distinction can scarcely be considered a good one, though on such only does the essential distinction between *Ruteæ* and *Zanthoxyleæ* rest, because, the rudiments of all the organs of perfect flowers constantly exist in both sexes, and only require a slight change of circumstances to render them perfect: on this account, I sus-



Rungia del.

TODDALIA ACULEATA.
(PERS.)

Molakarunnay Tam.

Kakatoddali. M.

Conda cashinda. T.

pect both Blume and Roxburgh have described the flowers of their respective genera, *Evodia* and *Fagara*, erroneously in making them perfect and bisexual. Of the former I cannot be certain, but can have no hesitation with reference to the latter Botanist having now before me male flowers of his *F. Rhetsa* and *F. triphylla*, the ovary of which, though apparently perfect, yet wants ovules and is sterile. Such is probably also the case with all Blume's species of *Evodia*, which must in that case, be brought here. This is the more likely to be the case, as all the other species of *Evodia* are from New Holland.

ZANTHOXYLON.

Z. triphyllum: (Juss.) Unarmed, leaves opposite, palmately trifoliolate, leaflets oval, oblong, acuminated, somewhat unequal sided at the base, glabrous: peduncles axillary, longer than the petiols, corymbs large, spreading; flowers numerous, minute: carpels 1-4, spreading, one seeded. Seed globose, glossy black.

Fagar triphylla, Roxb. *Evodia triphylla*, D'C.

Z. (Langsdorfia) *ovalifolium*, R. W. Unarmed, shrubby, leaves alternate, palmately 3 foliolate, leaflets oval, shortly acuminated, somewhat cuniate at the base, entire, glabrous on both sides: panicles axillary, longer than the leaves, contracted, the short side branches ending in small capitate clusters of flowers. Fruit about the size of a pea, 1-seeded. Seed globose, cotyledons thick and fleshy, albumen thin, membranous.

Shevagerry hills in flower, and fruit in August and September.

Z. (Langsdorfia) *sepearium*—Rigid, ramous, armed with numerous straight prickles: leaves palmately 3 foliolate, short petioled, leaflets oval, oblong, obtusely acuminated, crenulate on the margin, coriaceous, glabrous: panicles shorter than the leaves, contracted, speciform, few flowered. Fruit about the size of a pea, 1-seeded.

Pulicat hills near Madras.

This species is evidently very closely allied to the preceding, but is yet so different in every part of its habit that I cannot think of uniting them.

Toddalea aculeata and *T. floribunda.*

In our Prodromus we remark that between the specimens of my catalogue No. 532, and Wallich's *T. floribunda*, we could point out no character to separate them, unless the tubercles on the stem. The plant here figured is identical with the specimen alluded to, and has, as I have since found, the tubercled stem represented in Wallich's plate; hence is identical with it also. I therefore think that this may be received as a good species, and beg that the name on the plate may be changed from *aculeata* to *floribunda.*

EXPLANATION OF PLATE 66.

1. Toddalia floribunda, *Wallich—natural size.*
2. An expanded flower.
3. Stamens.
4-5. Sections of ovaries, showing them both sterile, and that this is actually a unisexual genus.
6. A female flower.
7. The ovary, the petals removed.
8. ——— cut transversely, 5-celled.
9. ——— cut vertically, ovules 2 in each cell, superposed.
10. A young fruit.
11. The same cut transversely.
12. A seed—*natural size.*
13. ——— magnified.
14. ——— cut transversely, showing the cotyledons enclosed in a thin albumen.

The figures representing the female flower were taken from specimens of *T. aculeata*, those of the other being all male plants.

SUB-ORDER—AILANTHEÆ.

This sub-order has been in a great measure treated of under the preceding, little therefore remains for this place. The genera referred to it were formerly placed by DeCandolle in his tribe *Connaraceæ* of the order *Terebinthaceæ*. Farther examination has led to that, at the time he wrote, ill understood order being greatly modified and to the removal of several of his tribes and genera to form new and distinct families. Those referred here were then transferred to *Rutaceae*, and more recently were by Dr. Arnott established as a 2d sub-order of that extensive order, an arrangement, partially adopted by Meissner who considers them a distinct tribe of *Zanthoxylaceae.* They principally differ from their associates in having solitary ovules and drupacious or samaroid (winged) fruit. Dr. Arnott gives the following character.

Sub-order 2.—*Ailantheae* (Arn.) Flowers unisexual, regular. Calyx 4-5, divided. Petals 4-5, alternate with the sepals: æstivation between valvular and twisted. Stamens as many as the petals and alternating, or twice as many, about the same length: filaments inserted round the base of the torus, not arising from scales: anthers 2-celled, bursting longitudinally. Torus discoid, or 4-lobed and cup-shaped. Ovaries several, distinct: ovules solitary in each cell, pendulous, styles very short, distinct, or slightly cohering at the origin of the stigmas: stigmas distinct, filiform, recurved, papillose. Carpels 3-5, distinct, indehiscent, drupacious or sama-

roid, 1-celled, 1-seeded. Albumen ? a thin fleshy plate, closely adhering to the integument of the seed, and resembling an inner coat. Embryo straight: radicle superior, short: cotyledons fleshy.—Trees or shrubs. Leaves alternate, exstipulate, equally or unequally pinnated, without pellucid dots.

Affinities. The affinities of this tribe have been already sufficiently explained.

Geographical Distribution. All the species of *Ailanthus* are of Asiatic origin, two are natives of India, one of the Moluccas and one of China. Of *Brucea* the original species was found by Bruce in Africa, to whom the genus is dedicated, one is a native of India, and one of Sumatra and the Malayan peninsula, of which I have also specimens from Ceylon, but according to Moon introduced. *Eurycoma,* a genus doubtfully referred here, is a Malayan plant.

Properties and Uses. The bark of *Ailanthus* excelsa "has a pleasant and slightly bitter taste, and is prescribed by the native practitioners in decoction in cases of Dyspepsia"—Ainslie. In confirmation of that statement I may add that some time ago specimens of this plant were sent me, as those of a tree, the bark of which is prescribed in the Circars as a powerful febrifuge, and tonic in diseases of debility. The wood of this species is white and soft, that of *A. glandulosa,* the Chinese species, is hard, heavy, glossy, like Satin, and is susceptible of a fine polish. The tree grows rapidly in England and forms a very ornamental one. The bark of both *Brucea antidysenterica* and *Samatrana* is intensely bitter. The former is considered in *Abyssinia* a sovereign remedy in dysentery and diarrhœa, and Roxburgh was in hopes that the Malayan one would, from the similarity of its sensible properties, be found equally useful in the cure of these complaints. The salt called *Brucine,* erroneously supposed to be derived from *B. antidysenterica,* a most acrid and powerful poison is now ascertained to have been obtained from the bark of *Nux vomica* or *Strychnos,* all the statements therefore that have been made concerning the danger of using *Brucea* and *Brucine,* belong to *Strychnos,* and have nothing to do with *Brucea* itself.—Lindley.

Remarks on Genera and Species. In our Prodromus we expressed doubts as to whether *Ailanthus malabaricus* was really distinct from *A. excelsa.* Specimens of leaves and flowers of the latter tree, communicated by the late Mr. Graham, of Bombay, corresponding with Rheede's figure enable me to testify to that extent, the correctness of his representation. The mature fruit I have not seen but the ovary differs somewhat from the generic character. It has three compressed distinct very obtuse carpels free from the base to the origin of the styles that is about two-thirds of their length: the styles are united throughout from the base to the apex and end in a large 3-lobed spreading stigma. It hence appears, that since the ovaries are distinct that the mature *Samara* can scarcely be united. In the earliest stages however, they are linear and rounded at the apex as in the plate. The specific character may be improved by the insertion of the words "ovaries 3, distinct, to the origin of the styles, rounded at the apex; style 1, short, thick, triangular, terminating in a broad spreading 3-lobed stigma, leaflets glabrous on both sides, glaucous beneath."

EXPLANATION OF PLATE 67.

1. Ailanthus excelsa, *male*—flowering branch, *nearly natural size.*
2. A male flower seen from above.
3. Anthers back and front views.
4. An ovary—*natural size.*
5. The same magnified but not well represented.
6. Cluster of carpels—*natural size.*
7. A carpel cut transversely, showing the solitary seed.

L.—SIMARUBEÆ.

This is a small tropical order of which two or three species only have been found on the continent of India; the remainder being from America, continental Africa, and Madagascar.

Rungia. del. *Winchester. Lith.*

பெரும்மரம். } Tam.
Paroomarum.

AILANTHUS EXCELSA. (*Roxb:*)

పెద్దమానుచెట్టు.
Pathamaunoochettoo. }

Ruengia del. SAMUDERA INDICA (GARTN) Winchester. Lith

They are most readily distinguished from the preceding orders, by the insertion of their stamens which in *Simarubeae* arise from the back of hypogynous scales like those of *Zygophylleae*, from which however they are distinguished by their distinct, not united, ovaries, and from *Xanthoxylaccae* by the absence of albumen in their seed. They are principally trees.

" Flowers usually bisexual, sometimes unisexual, regular. Calyx 4-5, divided. Petals as many as the sepals and alternate with them, hypogynous, spreading or connivent into a kind of tube: æstivation twisted. Stamens twice as many as the petals: each filament arising from the back of a hypogynous scale: anthers opening longitudinally. Torus a gynophore, bearing the stamens round its base, and the varies on its summit. Ovaries 5: ovule solitary in each cell, suspended from the inner angle near the apex: styles distinct at the base, but above it uniting into one: stigmas 4-5, distinct, or combined. Fruit of 4-5 indehiscent drupes, arranged round the summit of the gynophore. Seeds pendulous: testa membranaceous. Albumen none. Radicle superior, short, partly concealed within the thick cotyledons.—Shrubs or trees. Leaves alternate, exstipulate, without dots, simple or compound."

Affinities. They are allied to *Rutaceae* and its suborders as well as to *Connaraceae* and *Ochnaceae*, by their distinct ovaries and gynobase, but are distinguished from the former by the insertions of their stamens, and from the latter by their pendulous, not erect, ovules, and anthers, not opening by terminal pores, to which however they approach through their exalbuminous seed—Adr. de Jussieu remarks, they are known from all *Rutaceous* plants by the co-existence of these characters; namely, ovaries with but one ovule, indehiscent drupes, exalbuminous seeds, a membranous integument of the embryo, and by the radicle being retracted within thick cotyledons.

Geographical Distribution. The similarity of the Floras of the western coasts of the Indian peninsula of Ceylon and of the Malayan peninsula, is in many cases very remarkable, and in no case more so than in this: the only two Indian species of the order being found in these localities. *Samadera indica* is a native of Malabar and Ceylon, while *S. lucida* is from Martaban. There is one, most probably the latter, cultivated in the gardens about Batavia in Java. A third plant doubtfully referred to this order is found on the Himalayas, but forms a distinct genus.

Properties and Uses. Of this order the well known *Quassia* so remarkable for its pure and intense bitter is a member, and in that property all the other species partake in a greater or less degree. One species a native of Brazil, is said to be so intensely bitter that no insects will attack it. The Himalayan plant referred to possesses the peculiar bitterness of the family in an eminent degree, as does both the seed and the bark of the plant here figured.

EXPLANATION OF PLATE 68.

1. Samadera indica, flowering branch—*natural size.*
2. A flower partially dissected to show the insertions of the stamens and the ovary.
3. A detached stamen with its attached scale.
4. Stamens and petals removed, showing the elevated gynobase and the ovaries.
5. Ovaries cut transversely, showing the gynophore to which they are attached in the centre.
6. An ovary removed and cut vertically, to show the attachment of the ovule.
7. A cluster of full grown fruit.
8. One of them cut transversely.
9. A seed removed from the capsule.

LI.—OCHNACEÆ.

This like the preceding is a small order of tropical plants, for the most part under shrubs. Their most striking feature appertains to the fruit, one unfortunately not so well brought out as it ought and would to have been in the accompanying plate, had it been possible to procure them in a more advanced stage when preparing the drawing. In this order they are seated on a broad fleshy gynobase at first close to each other, but becoming quite distinct, like so many nine-pins, as they advance towards maturity, owing to the gynobase enlarging with their growth.

" Sepals 5, persistent: æstivation imbricated. Petals hypogynous, equal to or rarely more numerous than the sepals, deciduous, spreading: æstivation imbricated. Stamens 5, alternate with the petals, or 10, or indefinite, inserted on the hypogynous disk: filaments persistent: anthers 2-celled, erect, opening by pores. Ovaries as many as petals, distinct or rarely combined, seated upon the enlarged tumid torus: ovules solitary, erect: styles combined into one, which springs directly from the torus: from between the bases of the ovaries. Fruit (a sarcobase) of several indehiscent drupacious carpella, articulated with the torus. Seeds solitary. Albumen none. Embryo straight: radicle short, inferior: cotyledons thick. Glabrous trees or shrubs. Leaves alternate, simple, stipulate. Pedicels joined in the middle."

Affinities. In Dr. Lindley's recent arrangement, this order is placed at the head of his alliance *Rutales* of the group *Gynobaseosæ*, and well it might, as the gynobasic structure is more distinctly marked in this than in any of the other member of the group. It is readily distinguished from all the other by the dehiscence of its anthers which open by pores at the apex in place by a longitudinal slit, by its single style and erect solitary ovules, and from all those with divided styles, by the absence of pellucid dots in its leaves. In the characters of its fruit that excellent Botanist justly remarks it is " to polypetalous plants what *Labiatæ* and *Borragineæ* are to *Monopetalous.*"

Geographical Distribution. Tropical India, Africa, and America, are the native countries of the plants of this family, but they are by far the most numerous in America, scarcely one-fifth of the whole number being found in India. Our flora only extends to 5 species of about 50 described by authors: of these Roxburgh seems only to have been acquainted with one, the plant here figured, and quotes as a synonym a figure of Burman's (Thesaur Zeylan. tab. 56) which belongs to the allied genus *Gomphia.* Wallich in his list enumerates 12 species for all India and the Islands. The number so far as I am aware has not been augmented.

Properties and Uses. *Gomphia angustifolia* has we are told by Rheede, a bitter root and leaves, and is employed in Malabar as a tonic. The flowers of *Ochna squarrosa* are fragrant, but no part of the plant appears to be applied to any useful purpose.

Remarks on Genera and Species. On this head there is little scope for remark. *Ochna Wightiana*, however, it may be here remarked, differs somewhat from the character of the genus in having the styles deeply divided at the apex into as many parts as there are carpels to the ovary, each furnished with a capitate stigma: in place of having them united to the apex and having a single stigma. The anthers too are shorter than the filaments. These differences however scarcely admit of this species being separated to form the type of genus.

EXPLANATION OF PLATE 69.

1. Ochna squarrosa—*natural size.*
2. A flower, the petals removed to show the stamens.
3. Stamens back and front views.
4. The gynobase and ovaries with the style and stigma.
5. Ovaries cut vertically, showing their attachment to the base of the style, and their solitary erect ovules.
6. A detached ovary.
7. A seed approaching maturely cut transversely.
8. A carpel cut vertically, showing the position of the seed.
9. A seed removed and deprived of the testa.
10. A seed lobe, but through an error of the artist inverted and showing the radicle superior in place of inferior.

LII.—PITTOSPOREÆ.

A small order of plants, widely distributed, but principally confined to the tropics or the warmer portions of the temperate zones bordering on them, consisting of trees or shrubs with alternate, simple, entire, petioled, exstipulate leaves, and axillary and terminal, solitary, aggregated or racemose flowers.

" Sepals 5, deciduous, distinct, or partially cohering: æstivation imbricated. Petals 5, hypogynous, sometimes slightly cohering: æstivation imbricated. Stamens hypogynous, 5, distinct, alternate with the petals. Torus not discoid, but often forming a stalk to the ovary of about the same thickness. Ovary solitary, usually imperfectly 2-5 celled; the dissepiments not uniting at the axis, and therefore apparently 1-celled: style 1: stigma 2-5 lobed, the lobes

சேலநதிமரம
Salanthy marum

OCHNA SQUARROSA. (Linn.:)

PITTOSPORUM NEELGHERRENSE. (W.&.A)

equal in number to the placentas. Fruit baccate, or capsular, and loculicide; cells polyspermous, usually incomplete. Seeds covered with a glutinous or resinous pulp, or arillate. Embryo minute, contained in a fleshy albumen near the hilum: radicle long: cotyledons very short.—Leaves simple, alternate, exstipulate. Flowers sometimes polygamous."

Affinities. The affinities of this order are still undetermined, and no two Botanists, who have given their attention to the subject, seem to be agreed on the station they should occupy in the natural arrangement. "Brown in establishing this as an order remarks that it is widely different from *Rhamneæ* and *Celastrineæ*, but without pointing out its real affinity" (Lindley). DeCandolle places it next to *Polygaleae*, but without assigning any reason for so doing. Achille Richard places it between *Rutaceae* and *Geraniaceae*, and remarks regarding it that "The genera which compose this family were formerly placed among the *Rhamneae*, but their hypogynous insertion removes them to a great distance from that family. M. DeCandolle places the *Pittosporeae* between *Polygaleae* and *Frankeniaceae*, but it appears to us that this family should be placed near the *Rutaceae* which it resembles in a great many characters." Lindley on the other hand refers the order to his group *Albumenosae* and places it between *Ampeledeae* and *Olacineae*, with both of which it associates in the structure of the seed, though as it appears to me it differs greatly in other respects. Notwithstanding the opinion of Dr. Brown, quoted above, we have, in our Prodromus, placed it next to *Celastrineae*, forming the last order of DeCandolle's sub-class of exogenous plants Dichamydeæ Thalamifloræ. This arrangement has been adopted, with a doubt however by Meisner, but upon the whole seems more nearly correct than any of those which have gone before, and seems strongly supported by the fact of Dr. Roxburgh having referred one species of *Pittosporum* to the genus *Celastrus*, his *C. verticellatus* being in truth a *Pittosporum*. The variable character of the fruit in both, the loculicidal dehiscence of the capsular forms, and the usually albuminous seed of both, are all in favour of this station for the order, add to which, Bartling places it between *Rhamneae* and *Celastrineae* in his class *Tricoceae*.

Geographical Distribution. New Holland is unquestionably the head quarters of this order, all the genera, except *Pittosporum* and *Senaceae*, being confined to that country; species of *Pittosporum* are however very extensively distributed over the globe, being found not only widely diffused in Australia, but also in the Moluccas, China, Japan, and India, from the southern provinces of Ceylon up to the foot of the Himalaya mountains, and even in Madeira.

Properties and Uses. Nothing of any importance is known on this head. The wood of a species of *Senacia*, a native of the Mauritius, is handsomely veined, and the berries of a species of *Bellardiera* are eatable. The seeds of the Indian species are covered with a fragrant resinous fluid, which however soon dries on exposure to the air and loses its smell.

Remarks on Genera and Species. In addition to the three species of this order described in our Prodromus I have one undescribed from Ceylon, differing from all the others in having long obovate cuniate leaves and compound corymbose inflorescence: that is, the terminal shoot and each of the lateral branches of the corymb constitute so many small corymbs. The leaves blacken in drying, which is not the case with the other species so far as I have seen. It forms a large shrub growing on the banks of water courses on the more elevated parts of the Island.

Pittasporum Ceylanicum, (R.W.) Shrubby, diffuse, ramous, leaves obovate cuneate, bluntly acuminated, entire, glabrous, congested near the summits of the branches: panicles axillary and terminal; several together on the apex of the branches, springing from the axils of a whorl of 4 leaves: peduncles longish, filiform, each division corymbose, petals 5, linear, about three times the length of the sepals: young fruit densely clothed with greyish tomentum, and terminated by the persistent style and stigma: fruit glabrous, 2-celled.

Ceylon on the banks of streams among thick jungle.

EXPLANATION OF PLATE 70.

1. Pittosporum Neelgherrense—*natural size.*
2. A flower partially dissected, showing the insertion of the stamens, the ovary, style and stigma.
3. Anthers back and front views.
4. Ovary cut transversely, imperfectly 2-celled.
5. ——— vertically, ovules superposed.
6. A mature capsule after dehiscence.
7. A seed—*natural size.*
8. ——— *magnified.*
9. ——— cut transversely, all albuminous—the central circle a mere flourish of the draughtsman—*with the exceptions mentioned, all more or less magnified.*

DIV: II.—CALICIFLORÆ, D.C.

The families we have been hitherto describing are all referred by DeCandolle to his first division *Thalamiflorae:* distinguished by the inferior (hypogynous) insertion of the parts of the flower with reference to the ovary, in other words, by the insertion of the petals and stamens into the receptacle, the *Torus* being usually very narrow and unattached to the calyx. This division or class, owing to the constantly inferior insertion of the petals and stamens, has received from Jussieu the name of Hypopetalæ.

In the division, on the consideration of which we are now about to enter, the *Torus* is broad, and lines the bottom of the calyx, hence, the petals and stamens springing from its dilated and adnate part are commonly said to be inserted into the calyx. The petals in this division are either distinct or united together: and, the ovary is either free *(superior)*; or embraced by and united with the tube of the calyx by the torus, *(inferior.)*

This division is sub-divided into the following five classes—*Peripetalae—Epipetalae—Epicorollae Corisantherae*—(anthers distinct) *Epecorollae Synantherae*—(anthers united) and *Pericorollae.* The characters of these classes will be given at the head of each.

CLASS PERIPETALÆ.

Torus between the ovary and tube of the calyx, but not forming a disk on the summit of the ovary. Petals distinct, and stamens perigynous.

To this class is referable all those orders having a superior or free ovary.

CELASTRINEÆ.

This is a large family of plants partly tropical, but the greater number of them natives of the warmer regions bordering on the tropics. They are all trees or shrubs, with round or square branches, alternate or opposite, simple, or rarely compound, entire or dentate, petiolate, leaves: small deciduous stipules: and regular hermaphrodite small flowers, the bottom of which is lined with a large flat disk.

" Sepals 4-5, united at the base; æstivation imbricated. Petals as many as the sepals and alternating with them with a broad base, inserted under the margin of the torus; very rarely wanting: æstivation imbricated. Stamens alternate with the petals, and as many, inserted on the margin or disk of the torus: anthers 2-celled, dehiscing on the inner side. Torus a large thick fleshy flat disk, covering the bottom of the calyx. Ovary more or less immersed in and adhering to the torus, 2-5-celled, or rarely from abortion 1-celled: ovules usually two (sometimes only one, sometimes several) in each cell, attached to the axis, and usually at its base, at first ascending (sometimes afterwards by the elongation of the axis peritropal, or at last resupinately pendulous): styles 2-5, usually combined into one, sometimes distinct: stigmas combined or distinct. Fruit free from the calyx, 2-5-celled (often partly abortive): either indehiscent, drupacious, or baccate, or samaroid; or membranaceous and follicular; or capsular, 3-4-valved, and loculicidal. Seeds one or several in each cell, sometimes arillate. Albumen usually fleshy, sometimes very thin or wanting. Embryo straight: radicle short, pointing to the hilum: cotyledons usually thick.—Shrubs or trees. Leaves alternate or opposite."

Affinities.—Jussieu originally confounded this order with *Rhamneae,* from which it was afterwards separated by Brown on account of its imbricated æstivation, the stamens being alternate with, not opposed to, the petals as in that order, and its ovary always quite free. It is also nearly allied to *Hippocratiaceae* (which see) and to *Euphorbiaceae,* near which, in his alliance *Euphorbiales* Lindley places the order. Bartling takes a similar view and refers the order to his class *Tricoccae,* the type of which is the *Euphorbiaceae.* Brogniart, who has so ably illustrated the *Rhamneae,* states it as his conviction that *Celastrineae* have more relation to some orders with hypogynous stamens, especially *Malpighiaceae,* than to any with peri-

gynous ones. Achille Richard places it between *Rhamneae* and *Euphorbiaceae:* Blume however continues to follow Jussieu in uniting them to *Rhamneae.* As all these eminent Botanists seem agreed on the one point, that this order forms the transition from the hypogynous to the perigynous divisions of DeCandolle's arrangement, the one adopted in this work, it seems evident, that it is most judiciously placed in its present situation as the connecting link between the two.

Geographical Distribution. This is a very widely distributed order, species being met with in the warmer regions of every quarter of the globe, but much more abundantly beyond than within the tropics. The Spindle tree, *Euonemus Europaeus* is a native of the north of Europe, and has several congeners in the Himalayas, and also in the alpine districts of this Peninsula. I have two species from the hills about Courtallum, and excluding one or two, which I am as yet unable to determine, two from the Neilgherries. *Celastrus* in like manner has a wide range in India, extending from the southern extremity of Ceylon up to the Himalayas, several species occurring at either end of these distant limits. Species of both of these genera are found in Java and China, as well as in America, and of the latter, in Africa. *Celastrus coreaceus* of Senegambia, seems indeed almost identical with our *C. montana.* *Elaeodendron* has fewer species and a more limited range, being confined to the East and West Indies, and has one species in Norfolk Island. The tribe *Ilicineae* of which the *Holly* is the type has recently been removed from this, and placed as a separate order among the monopetalous orders, where it ranks near the Ebony's and Olives. Dr. Wallich's genus *Kurrimia* is found in Silhet and Ceylon, from the last of which stations I have two species. According to Wallich's list there are about 70 species, natives of India, referable to this order.

Properties and Uses. But little is known of these. The berries of *Euonemus Europaeus* are said to be violently emetic, and to prove poisonous to sheep. Of the Indian species, not one is mentioned by Ainslie as being used in medicine. The researches however of the late Dr. Herklots brought one to light well known to the natives as possessed of very peculiar powers, the seed namely of *Celastrus nutans* (Malkungnee of the natives), from which he extracted, by a rather rude process an Emperumatic oil. This he administered with great success in Berriberri. In other hands it has not proved quite so successful. As however the subject is as yet imperfectly known and seems to merit further inquiry, I presume I need offer no apology for introducing a rather long extract from Mr. Malcolmson's essay on Berriberri, giving some account of its introduction into medical practice, and of its active constituents, as ascertained by chemical analysis, in the hope, that the very simple and easily made experiments of Mr. M. may induce others to extend the enquiry to the seed of other species, and thence perhaps, add another not less powerful remedial agent from a family which has not hitherto been sufficiently investigated.

" Oleum Nigrum, (Herklots). It remains to communicate such observations as I have made, regarding another native remedy of great value, styled by Dr. Herklots, to whom we owe its first introduction to the notice of Europeans, the oleum nigrum. It is prepared in the following manner. Into an earthen pot whose bottom is perforated by a number of small holes are put, malkungnee seeds ℔ijss, benzoin, cloves, nutmegs, mace, of each ℥ss; the mouth is closed and the pot placed over another and luted to it. They are then placed in a pit three feet deep and nearly as wide, and surrounded by cakes of dry cow-dung which are set on fire, and when they are consumed about six ounces of the oil is found in the under vessel ready for use. It should be kept in well closed bottles. As we would expect from the nature of the process, the appearance and sensible qualities of the product resemble those of an emphreumatic oil, possessing the peculiar powers of the principal ingredient, the malkungnee seeds. These do not appear to be the produce of the Circars, or as far as I can learn, of the Deccan, but Mr. Royle has included them in a list of Indian materia medica, and states that the plant is the *Celastrus nutans.*[151] It is stated by Hukeem Mahomed Hussein Khan, to be a native of Hindoostan, and the seeds are imported from Calcutta or brought to the Circars from Hyderabad, and are only found in the principal towns, where they are kept in bags containing the seeds, seed vessels and

stalks, from which the genus can be ascertained, as was done by Dr. Wight some years before the publication of Mr. Royle's catalogue. The name used in Hindoostan has been introduced into Arabic, Persian, Teloogoo, and Tamul. A tree called by the Mahrattas "malkanee," the seeds of which afford an oil, grows in the forest of Dongatal, north of Nagpore, but I did not see the tree nor am I sure that it is the same.[151] The seeds differ in quality, sometimes from age, but I have seen very fresh ones of inferior quality, apparently from their being pulled too soon. When new, the seeds are partially surrounded by a yellow unctuous tasteless farina, and when they are reduced to powder they form a paste from which a yellow oil, having in some degree the qualities of the seeds, may be expressed. These have a hot biting taste, permanent in the palate, and if many of them are masticated, a sense of giddiness and a peculiar slight sensation extending over the face and brow are felt. A very slight taste and no acrimony is given to water distilled from them, and the oil on the surface of the residuum is bland. The seeds retain their taste. It was evident from this, that their virtues did not reside either in a fixed or volatile oil. Some of the seeds were coarsely powdered, and alcohol rubbed up with them and afterwards filtered; it had acquired a light yellow tinge. On this being dropped into water, an immediate separation of the resin it held in solution took place, in a white flake, which had a strong biting acrid taste exactly like that of the seeds, but much more powerful, and in which it appears the virtues of the plant reside. The alcoholic solution evaporated, leaves a beautiful yellow resinous paste which also possesses the qualities of the seeds. The black oil itself is a thick deep brown fluid, burning with a white flame and not acted on by acids. Its specific gravity is, at ninety, 1097,5, which is higher than any of the fixed oils; its taste is rough, bitterish and acrid, its smell empyreumatic and peculiar. Water distilled from it is limpid, but has a good deal of the taste of the seeds, and the oil floating on the water in the retort is tasteless. The oil when rubbed up with alcohol forms a deep olive brown partial solution, and there is only a thick oily matter left on the filter, which has much less taste than the oil itself or the oily tincture. This last, on being dropped into water, separates into a white flake sinking in the water and of the same quality as that obtained from the alcoholic solution of the seeds, and a fixed black oil having a slight bitter oily taste. On the mixture of the oil and alcohol standing for some time, the fixed oil partly separates from the tincture; and seems to pass through the filter with, but not dissolved by it. From these observations it appears, that the resin is combined with the oils existing in the ingredients employed, which are partly converted into an empyreumatic compound, and thus acquire the property of partially dissolving the resin."

Remarks on Genera and Species. Five genera only of this order had been met with in this country at the time we published our Prodromus, since then I have added one (Icones Plant. No. 162) intermediate between *Celastrus* and *Euonymus*. Of these I find Meisner proposes to change the name of one, substituting *Schrebera* for *Elæodendron*. Our *Elæodendron* being in truth Retz's *Schrebera* but not Linnæus', I confess I am not prepared to coincide with him in this alteration, for so far as I can see, he has not afforded satisfactory reasons for doing so: the characters of his genera *Elæodendron* and *Schrebera*, with the exception of the seed, being in effect the same. It appears to me, he has been induced to change our name, partly by a remark of ours to the effect that "if Gærtner be correct in describing the fruit of *El. orientale*, the type of the genus, as a 3-celled drupe, the seeds with a fleshy albumen, and remarkably thin membranous cotyledons, then the Indian species must be removed." This passage is guarded by an *if*—and not without reason, since it does not appear by any means certain, that Gærtner's *E. indicum*, is identical with Jacquant's *E. orientale*, on the contrary, he (Jacquant) particularly mentions the 2-celled nut, which renders their identity very doubtful. With reference to the only other distinction assigned, viz. the seed being exalbuminous with thick cotyledons in the one; and sparingly furnished with albumen and having thin foliaceous cotyledons in the other; I consider it a mark of inferior importance, and object to it the more, as being in this instance a very unnecessary refinement, and but little applicable to general practice, where we have so often to distinguish genera from flowering specimens only. For these reasons I cannot with my present information adopt the innovation. A curious blunder of Meisner's may be here noticed, as it seems not improbable it had some influence in leading him to make two genera, where I think one might have

served—He says, " *Obs. Schrebera stamina apud Schreb.* (gen. 446) *et Juss. l. c.* (gen. plant) *decuntur basi intus squamulis minutis ciliatis prædita, quarum vero nulla facta est mentio in char-generico apud.* W and Arn." The error here is, in supposing the *Schrebera* of Linnæus and *Retz* the same—the Linnæan plant to which the *squamulis minutis ciliatis* belongs, is a species of *Cusuita*—and the Linnæan *S. schinoides* was *Cuscuta Africana* growing on a *Myrica.* In the *Schrebera* of *Retz* no such character exists, and as already remarked, I think it an unnecessary genus, and regret to see it taken up anew, by so excellent a Botanist as Meisner, in a work so likely from its general accuracy to have an extensive circulation and to be looked up to as one of considerable authority.

The genus *Lophopetalum* is characterized by having a 5-lobed calyx : 5 petals, each furnished with a crest, inserted under the margin of the torus : 5 stamens inserted on the surface of the disk; a broad 5-lobed disk covering the whole hollow of the calyx, the lobes opposite, covering, and adnate with the base of the petals, and a 3-celled superior ovary with two rows of ascending collateral ovules in each cell.

This genus is exactly intermediate between *Celastrus* and *Euonymus*, having the 3-celled ovary and quinary petals of the former combined with the insertion of the stamens on the face of the disk the cymose inflorescence and opposite leaves of the latter. It differs from *Celastrus* in habit and in the insertion of its stamens; and from *Euonymus* in the unequal number of the cells of its ovary and petals, and in the cells being polysporous. Adopting these last as the essential characters of the genus, the crested petals, from which it takes its name, and the lobed disk may be viewed as characters of secondary importance, and thus a third species, of which I have specimens, partaking of the essential characters but wanting the others, might be introduced. Dr. Arnott proposes to add as a fourth species Wallich's *Euonymus grandiflorus,* which I cannot adopt, owing to its having 4 petals, 4 stamens, and a 4-celled ovary, thus virtually destroying what I consider the essential character of the genus, namely, the inequality existing between the floral envelopes and cells of the ovary. That plant ought perhaps to form the type of a genus, distinct from *Euonymus*, depending on its numerous ovules and seed but ought not to be allowed to mar the uniformity of this, by combining under one name, plants having symmetrical and insymmetrical flowers.

The genus *Euonymus* though not very extensive will I suspect require revision, but this cannot be undertaken until we are better acquainted with the fruit. Some new species of it are found on the Neilgherries of which I have specimens communicated by Mr. Gough, an enterprising young Botanist, who explored much of these elevated regions, but who is, unhappily for science, forced by bad health to leave the scene of his usefulness. Two of these can be readily defined, the rest cannot be satisfactorily made out and must be left for future investigation, since, it is worse than useless to name plants which we have not the means of describing with sufficient precision to admit of their being afterwards recognized from the description.

Judging from a solitary not very perfect specimen in my herbarium of the *Eu. fimbriatus* Wall. a native of the Himalayas, communicated by the late Countess of Dalhousie, it appears, that that species belongs to the genus *Pterocelastrus* of Meisner, one hitherto only found at the Cape. My specimen is not in fruit, but the ovaries, shortly after the fall of the flowers, show the wings of the carpels already well formed. The specimen is from Masoori, and has much the habit of an *Euonymus.* This plant along *E. japonicus,* equally a native of Nepaul and Japan, adds another to the, already existing, numerous links, between the floras of these remote countries.

LOPHOPETALUM, (R. W.)

Calyx scutelliform, 5-lobed, lobes rounded, short. Petals 5, sessile, orbiculate, expanding, usually, furnished with a crest, and covered near the base with the projecting lobes of the disk. Torus discoid, 5-lobed, or angled, thick, fleshy, covering the whole cavity of the calyx, the lobes adnate to the base of the petals. Stamens 5, alternate with the petals, inserted on the disk, anthers versatile, ovate, 2-celled, dehiscing longitudinally, ovary free, 3-celled, ovules in a double series, 4-12, in each cell, ascending, style short, persistent, stigma obtuse, capsule —, seed —.

Glabrous trees, or shrubs, leaves opposite, petioled. Flowers numerous, on large spreading terminal cymes: Petals sometimes without a crest and the disk not lobed.

In the construction of this character, which is considerably altered from that published in the Icones I have availed myself both of a more extended acquaintance with the order, derived from recent study, and of Dr. Arnott's character, which reached me as this article was passing through the press, to improve it to the utmost, and at the same time, so to fix its limits as to prevent them interfering with those of *Euonymus,*which

Dr. Arnott's character does not attain, and in so far weakens both. I give below Dr. Arnott's generic character.*

The genus naturally divides itself into two sections, one distinguished by its crested petals and projecting lobes of the disk, the other by the petals being without a crest, and having a 5-angled not 5-lobed disk.

§ 1. *Petals crested, disk 5-lobed, lobes adnate to the bases of the petals.*

1. *L. Wightianum*, Arn. Leaves elliptic, oblong, slightly acuminated, quite entire, coriaceous, slightly villous beneath; crest of the petals a corrugated membrane.

Hab.—*Malabar.*

The villi on the under surface of the leaves, in this species is much more sensible to the touch than evident to the eye, even when assisted with a high magnifier.

2. *L. fimbriatum.* Leaves ovate, oblong, slightly acuminated, quite entire, membranous, glabrous on both sides, crest of the petals fimbriated.

Hab.—*Mergui* —Griffith.

The much thinner and membranous leaves with the fimbriated crest of the petals at once distinguish this from, the former species. In addition to which the flowers are scarcely half the size.

§ 2. *Petals not crested, disk 5-angled, not lobed, angles alternate with the petals.*

This section ought perhaps to form a distinct genus.

3. *L. floribundum*, R. W. Leaves linear elliptic, acuminated, quite entire, coriaceous, glabrous on both sides; panicles large, diffuse, many-flowered; flowers small, young capsules (?) acutely triangular, pointed.

Hab.—*Mergui.*—Griffith.

This is a most distinct species, and cannot be confounded with either of the preceding, but it is still doubtful to me, whether it ought to remain in the genus.

EUONYMUS.

E. Goughii, (R. W.) Shrubby, glabrous, ramuli compressed: leaves somewhat tripli nerved shortly petioled, quite entire, oblong ovate, acute at both ends, acuminated: peduncles axillary, short, 1-3 flowered: calyx cuellate, 5-lobed: petals 5, orbicular, fimbriated on the margin: stamens5, inserted on the disk, connectivum of the anthers broad, cells placed transversely, dehiscing lengthwise, ovary immersed in the disk, 5-celled, with two ovules in each.

Hab.—*Neilgherries.*—Gough.

This species seems to approach *E. grandiflorus*, (Wall.) in the size of its flowers, but differs in the quinary not quaternary number of parts, and in its petals being fimbriate on the margin.

2. *E. acutangulus.* Younger branches and ramuli acutely 4-angled, glabrous: leaves coriaceous, glabrous, quite entire, ovate, acuminated: cymes axillary, peduncles about half the length of the leaves, twice or thrice dichotomous: capsules conical, broad, truncated above, tapering downwards, 5-celled.

Neilgherries.—Gough.

For specimens of both these species I am indebted to Mr. Gough, who gathered them in the course of his excursions on the Hills.

3. *E. revolutus*, R. W. Young shoots, obtusely 4-angled, afterwards terate: leaves subsessile, coriaceous, revolute on the margin, quite entire, from elliptic to obovate-cunniate, with a short blunt acumination: peduncles axillary, paired, slender, 1-3 flowered, about one-fourth the length of the leaves; when one flowered, furnished with two minute bracts above the middle: calyx 5-lobed, lobes rounded: petals 5, orbicular: ovary immersed in the disk, 5-celled, with two ovules in each.

Hab.—*Ceylon.*

E. Walkerii, R. W. Branches slender, terate, extreme, shoots obscurely 4-sided: leaves subsessile, ovate, acuminated at both ends, serrated towards the apex, quite entire below, somewhat coriaceous, glabrous: peduncles axillary, short, once or twice dichotomous; flowers small, petals 5, orbicular, slightly undulated on the margin, capsule conical, 5-celled, large, 5-angled, turbinato at the apex.

Hab.—*Ceylon.*

Flowering specimens of this plant were first communicated to me by Colonel Walker, I afterwards collected them in fruit, between the two there are some unimportant differences, the leaves of the flowering specimens being larger, endingin a longer and more pointed acumen and more acutely serrated. These differences however could not be employed as specific characters to separate the two forms.

* *Calyx* scutelliformis 4-5-lobus, lobis rotundatis brevibus. *Petala* 4-5 sessilia orbiculata patentia, supra circa basin cristis lobulisque carnosis instructa versus marginem nuda lævia. *Torus* discoideus, 4-5-gonus crassus carnosus calycis cavitatem omnino implens. *Stamina* 4—5, petalis alterna, supra discum inserta: filamenta persistentia subulata. *Antheræ* ovatæ, biloculares, longitudinaliter dehiscentes. *Ovarium* disco semi-immersum, 3-4-loculare. *Ovula* biserialia, 8-12 in quoque loculo adscendentia. *Stylus* brevis persistens. *Stigma* obtusum. *Capsula* 3-4-angularis, 3-4-locularis, loculicide dehiscens, loculis sub-dispermis. *Semina* arillata.

EXPLANATION OF PLATE 71.

Elæodendron Roxburghii—1. Flowering branch—*natural size.*

2. An expanded flower seen from above.

3. The same, the petals removed to bring more clearly into view the disk and insertion of the stamens under its edge.

4. Stamens back and front views.

5. Ovary cut vertically, showing the ovules attached to the base, erect.

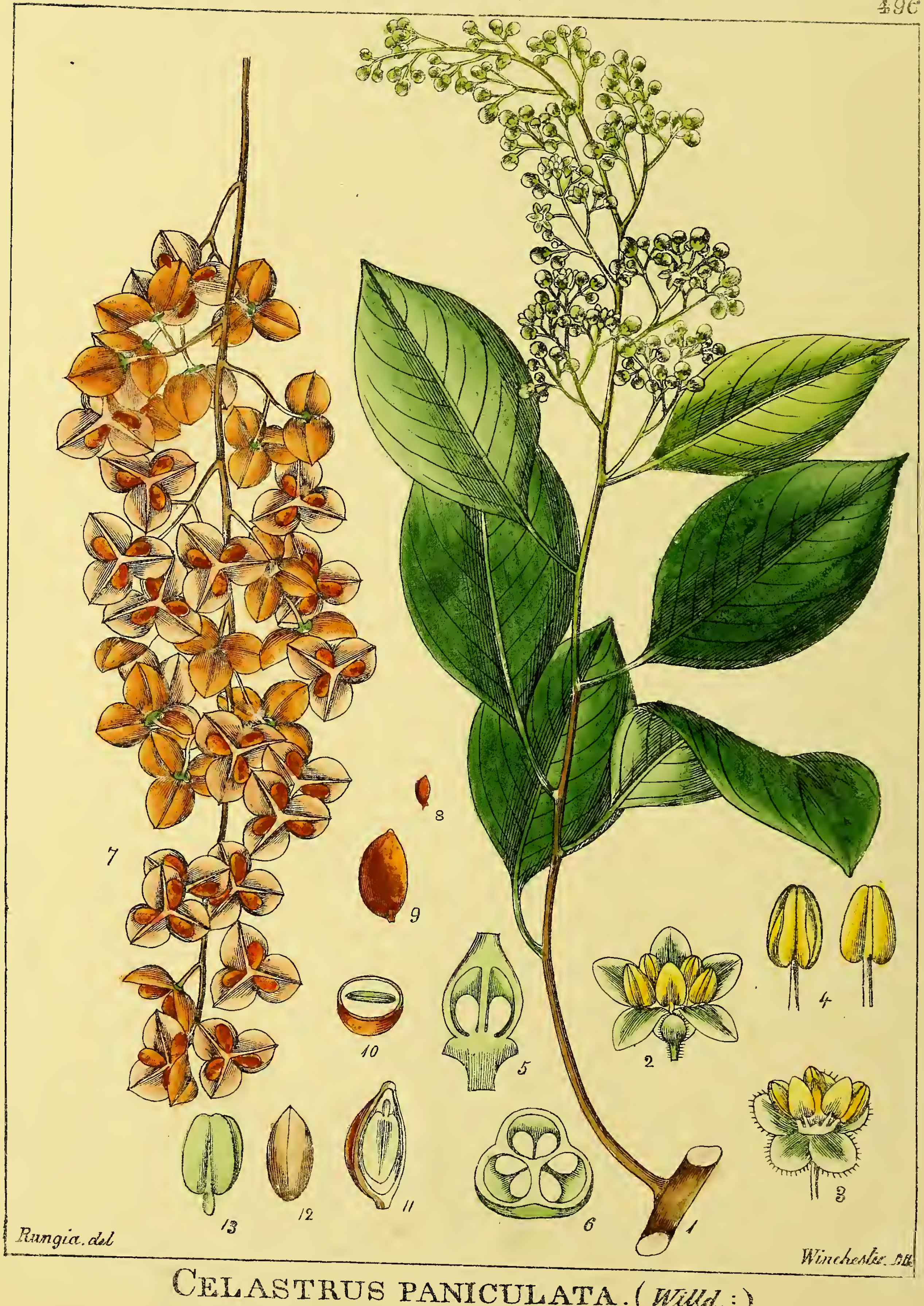
6. Ovary cut transversely, showing it 2-celled, with two ovules in each.

7. A fruit nearly full grown.

8. Cut transversely, 1-celled, 1-seeded, the other ovules having aborted.

9. The same cut vertically, the seed still immature and not yet filling the cavity of the cell—*all more or less magnified.*

ELÆODENDRON ROXBURGHII. (W. & A.:)



CELASTRUS PANICULATA. (*Willd.*:).

EXPLANATION OF PLATE 72.

Celatrus paniculata—1. Flowering branch male plant —*natural size.*
2. An expanded flower seen from above.
3. The same, the petals removed, but the disk not clearly shown.
4. Stamens back and front views.
5. Ovary cut vertically, ovules erect.
6. ———— transversely, 3-celled, with two ovules in each.
7. A raceme of fruit—*natural size.*
8. A seed—*natural size.*
9. The same—*magnified.*
10. A seed cut transversely, showing the embryo surrounded by copious albumen.
11. Cut vertically, showing the embryo *in situ.*
12. The seed, the testa removed.
13. The embryo detached, cotyledons foliaceous.

LIII.—RHAMNEÆ.

This like the last is a large order and like it distributed over every part of the world, except perhaps within the Polar circles being found throughout both the temperate, and the torrid zones. It consists for the most part of trees and shrubs, sometimes scandent, often erect, many of them armed with thorns or stipulary prickles. In most the leaves are alternate and in nearly all the flowers are small and inconspicuous, but with varied inflorescence, being axillary and fascicled, or subspicate, racemose or panicled. The fruit is equally variable being drupaceous and indehiscent with a very hard several-celled nut, or capsular and dehiscent, dividing into three valves. They however nearly all agree in having a 4 or 5-cleft calyx with valvate æstivation, small scale-like petals, and the stamens opposite the petals inserted under the edge of a flat disk which fills the whole cavity of the calyx, and covers the ovary: occasionally, as in *Rhamnus*, the flowers are unisexual, and one or two genera are said to have the ovary inferior.

" Calyx 4-5-cleft; æstivation valvate. Petals distinct, unguiculate, cucullate or convolute, or rarely flat, inserted into the throat of the calyx, sometimes wanting. Stamens definite, opposite the petals. Torus a flat or urceolate disk. Ovarium free or more or less immersed in the disk, or adhering to the tube of the calyx, 2-3-4-celled: ovules solitary, erect. Fruit free or more or less cohering with the calyx, fleshy and indehiscent, or dry and separating in three cocci. Seeds erect. Albumen fleshy, rarely none. Embryo about as long as the seed: radicle short, inferior: cotyledons large, flat.—Trees or shrubs, often thorny. Leaves simple, alternate (or rarely opposite), minutely stipulate."

Affinities. These are somewhat complex as they are considered rather nearly allied to several orders far removed from them according to the arrangement followed here such as *Euphorbiaceæ*, *Byttneriaceæ*, *Rosaceæ*, &c., but those with which they seem most nearly to associate are the *Celastrineæ* and *Ilicineæ*, with which they were long confounded. From the former they were removed by Brown on account of their valvular, not imbricate, æstivation of the calyx; their stamens opposite, not alternate with, the petals: their indehiscent not capsular fruit, or when capsular septicidal not loculicidal dehiscence. From *Ilicineæ* they are separated by the valvate æstivation of their calyx and by their discoid polypetalous, not monopetalous diskless, flowers. With *Pomaceæ* they agree in the determinate number of cells of the ovary, in their ascending ovules, and alternate leaves. Generally speaking however they are easily distinguished from all these by their minute scale-like petals opposite the stamens, such certainly is the case with all those I have met with in India.

Geographical Distribution. Of the numerous species referred to this order some are found suited to almost every climate, the Arctic and Antarctic circles excepted. *Rhamnus catharticus* with some others being found extensively distributed through the more northerly countries of Europe, while *Rhamnus hirsuta* and *Wightii* are both found in the most southerly parts of India within a few degrees of the line—New Holland: North and South America: the Cape of Good Hope and Senegal in Africa: the Eastern Islands and China all claim indigenous species of this extensively distributed order. In India they abound, every jungle being profusely supplied with some species of *Zizyphus*, and of about 40 genera referred by Meisner to the order, 13 or about one-third of the whole are natives of India, showing how largely it partakes of the tropical character.

Properties and Uses. The well known Buckthorn, *Rhamnus catharticus*, belongs to this family, and the cathartic properties of its fruit are common to several other members of the genus. . The fruit of *Zizyphus* on the other hand are destitute of cathartic qualities, and some of them are even wholesome and pleasant to eat among which the well known Bhir fruit, *Zizyphus jujuba*, may be mentioned. In China the peduncles of *Hovenia dulces* swell and become succulent, and are there much esteemed as a fruit resembling a ripe pear. *Sageretia Theezans* another Chinese plant, a member of this order is used there in place of tea by the poorer classes. Some other species are used medicinally in America, but upon the whole this order cannot boast the possession of any very important property, though, those it does enjoy, are of so mixed a character. The natives of this country use two or three species medicinally, but apparently place little reliance on them, as they seem to be employed rather as vehicles for the administration of more active ones, than for any useful quality they possess.

Remarks on Genera and Species. The genera of this order have been ably elucidated by Brogniart in his memoir on this family, published in the *Annal. des Sciences Naturelles*, who has on this head left almost nothing to be desired. In our Prodromus we have adopted his genera so far as the Peninsular flora extends, but that is not far, as we have only seven genera out of about 32 referred by him to the order. My recent collections have not added to the number, though one or two new species have been found, one, namely, of *Berchemia* and one of *Colubrina*. I have besides some variations of forms already described, but which I do not think can be elevated to the rank of species. The genera are conveniently divided into two sections, those namely, with dehiscent, and those with indehiscent fruit. To the former belongs *Gouania*, *Colubrina* and *Scutia*: to the latter *Berchemia*, *Rhamnus*, *Zizyphus*, and *Ventilago*—figures of all these except *Gouania* are now published in this work and in the Icones, and do not require further notice here.

EXPLANATION OF PLATE 73.

Scutia India—1. A branch bearing both flowers and fruit—*natural size.*

2. The calyx, petals and stamens removed from the ovary.

3. Back and front views of the stamens, the latter with the petal still attached.

4. The ovary detached from the flower.

5. ——— cut vertically, ovules erect.

6. The ovary cut transversely, 2-celled, with a solitary ovule in each.

7. A fruit nearly full grown.

8. ——— cut transversely, 2-seeded, seeds compressed.

9. A seed—*natural size.*

10. The same cut transversely, showing the embryo surrounded by albumen—*with the exceptions mentioned, all more or less magnified.*

EXPLANATION OF PLATE 74.

1. Colubrina Asiatica—*natural size.*
2. An expanded flower seen from above.
3. Stamens back and front views.
4. A full grown fruit cut transversely, 3-celled, with three triangular albuminous seed.
5. A seed—*natural size.*
6. The same—*magnified.*
7. Cut transversely, showing the foliaceous cotyledons enclosed in albumen.
8. The embryo detached—*with the exceptions mentioned, all more or less magnified.*

LIV.— TEREBINTHACEÆ.

As now constituted this is a large order of plants consisting of trees and shrubs, for the most part abounding with Balsamic resinous juices, but differing so much among themselves, both in their properties and Botanical characters, that it is almost impossible to bring them together, as one well digested order, by any combination of characters not including nearly as many negative as there are positive marks. To avoid this difficulty, which would have appeared more striking where there are so few to be described, we, in our Prodromus did not attempt to give a character of the whole order, but only of these sections or suborders appertaining to our flora. By this means, aided by the removal of the tribe *Connaraceæ* as a distinct order, and of *Toddalia* and *Ailanthus* to *Zanthoxylaceæ*, the Indian branch of the order, as it now stands in our

SCUTIA INDICA. (*Brongn.*:)

COLUBRINA ASIATICA. (Brongn.)

work, is, I believe, as nearly correct as our present imperfect knowledge of the tribe enables us to approach. The whole order certainly requires revision, and it is to be hoped some European Botanist, favourably situated for the performance of the work will undertake to supply this Botanical desideratum. In the mean time, it may be observed, that, the order as left by Kunth and DeCandolle has been completely broken by Bartling and Lindley, while it has been preserved entire by Meisner, though, with the works of both these latter authors before him. Bartling does not depart very widely from DeCandolle for he groups the whole under his class, TEREBINTHACEÆ: the definition of which however can be of little use in practice as its negative and positive characters nearly balance each other. It has the segments of the calyx imbricated (they are valvate in *Burseraceæ* which he unites with *Amyrideæ*) petals and stamens definite, hypogynous or subperigynous: ovaries 1-5 distinct or united (*Ochna* one of his *Terebinthaceæ* has sometimes as many as 10.) Pericarp double, the laminæ separating spontaneously or divisible: seeds albuminous or exalbuminous. Embryo straight or curved. Leaves compound or simple, often with pellucid glandular points—every positive has here its saving negative, hence it can be of little value, in doubtful cases, in practice, even though, with one or two exceptions, the orders ranged under it have many very striking affinities, and form upon the whole, in their properties a natural group—they are—*Ochnaceæ, Semarubeæ, Zanthoxylaceæ, Diosmeae, Rutaceae, Zygophylleae, Aurantiaceae, Amyrideae,* (our *Burseraceae*) *Connaraceae, Cassuvieae,* (our *Anacardiaceae*) and doubtfully, *Juglandeae*—(the walnut family). This arrangement has the advantage of forming in some respects a very natural group, but has the disadvantage, of bringing together a number of orders, the Botanical characters of which are so far at variance as to render them in other respects badly associated. Dr. Lindley's distribution seems to me to be subject to similar objections, but on this point I would speak with much reserve, for, from having been long accustomed to view their connections in one light I may not be able to recognize them when placed in a different.

Meisner retains the order as left by Kunth and DeCandolle with the exception of a few genera referred to *Zanthoxylaceae.* He distributes the order under two primary divisions, namely—1st, those having a single ovary or at least containing only one perfect cell: and 2dly, those with a many-celled ovary or with several distinct perfect ovaries.

The first of these divisions he again divides into three subdivisions or tribes, *Juglandeae, Amyrideae,* and *Cassuvieae.* The last, which is the only one of the three having reference to the Botany of this portion of India, is distinguished: by having several ovaries but all except one aborting, the perfect one having but one ovule: flowers usually unisexual, rarely apetalous; stamens perigynous; filaments free or united at the base; indehiscent, drupaceous fruit, and pendulous, or rarely ascending, exalbuminous seed. The leaves, except in *Bouea,* (an Indian genus) alternate, simple or compound, exstipulate.

This tribe is divided into two subtribes *Sumachineae* and *Anacardieae*—the first is distinguished by having foliaceous or flat, not thick fleshy, cotyledons, the last by the cotyledons being thick and fleshy. To the former of these tribes *Odina* and *Rhus* of our flora belong, to the latter *Sorindeja, Pegea,* (a genus omitted in our Prodromus as not being a native of the peninsula) *Solenocarpus, Holegarna, Bouea,* Meisner (a native of India but so far as I am aware not of the peninsula) *Mangifera, Semecarpus, Buchanania, Melanorrhaea* (Wall.) and *Anacardium.*

The second primary division is also subdivided into three tribes *Spondiaceae, Burseraceae,* and *Connaraceae.* In *Spondiaceae,* the cells of the ovary have one ovule—in *Burseraceae* they have two collateral pendulous ovules, and in *Connaraceae* the cells themselves are distinct with two ovules in each, but they have been already disposed of as a distinct order. *Spondias* is the only genus found in this part of India referable to the first of these tribes: to the second *Boswellia Icica Balsamodendron,* (second section of our Protium) *Protium Garuga* and *Canarium* belong. Such is a brief but I fear imperfect exposition of the order as it relates to Indian Botany, given in the most recent work to which I have access, from which it will be seen, on a comparison with our distribution, that it is nearly the same throughout, so far as our work extends.

With the slender materials in my possession I cannot venture to give a complete character of an order, embracing according to Meisner, six tribes and upwards of 60 genera, I shall therefore content myself with copying from our Prodromus for the benefit of those who may not have access to the work itself, our characters of the three suborders under which we have

distributed the order, each of which may, in some measure, be looked upon as a distinct order, and is so viewed by both Bartling and Lindley.

" *Suborder* 1. *Anacardieae* (Br.) Flowers usually unisexual. Calyx usually small, 5-(sometimes 3-4-7-) cleft; the fifth segment superior. Corolla regular. Petals equal in number to the divisions of the calyx (sometimes wanting), perigynous: æstivation imbricative or rarely valvular. Stamens equal in number to the petals and alternate with them, or twice as many or more: filaments distinct or cohering at the base, perigynous. Torus (in the free ovary) fleshy, usually discoid (annular or lobed or cup shaped), or at first inconspicuous but afterwards enlarged into a gynophore. Ovarium solitary (of 1-5 carpels, distinct or united, but all abortive except one) free, or rarely adhering to the calyx, 1-celled (or sometimes with two additional abortive cells, the remains of the imperfect carpels): ovule solitary, attached to a podosperm which always arises from the base of the cell, but is frequently adnate to one of its sides to near the apex: styles usually 3 (or occasionally 4), rarely 5, usually distinct, very rarely combined: stigmas as many. Fruit 1-celled, indehiscent, usually drupaceous. Seed ascending, or more frequently pendulous. Albumen none. Radicle superior or inferior, next the hilum (very rarely at the opposite extremity) sometimes curved suddenly back: cotyledons thick and fleshy or leafy. Trees or shrubs, with a resinous, gummy, caustic, or milky juice. Leaves alternate, not dotted, without stipules."

Suborder 2. *Spondieae* (Kunth.) Flowers sometimes unisexual. Calyx 5-cleft, regular. Petals 5, equal; æstivation between valvate and imbricate. Stamens 10, perigynous, distinct. Torus large, discoid. Ovarium superior, sessile, 2-5-celled: ovules solitary, pendulous: styles, 5 short: stigmas obtuse. Fruit drupaceous, 2-5 celled. Seed solitary in each cell. Albumen none. Radicle pointing to the hilum: cotyledons plano-convex.—Trees. Leaves imparipinnate, alternate, not dotted, exstipulate.

Suborder 3. *Bursereae* (Kunth.) Flowers usually bisexual. Calyx persistent, somewhat regular, 2-5 divided. Petals 3-5, equal: æstivation usually valvular. Stamens two or four times as many as petals, distinct, perigynous. Torus orbicular. Ovarium 2-5 celled, superior, sessile: ovules in pairs, collateral, suspended: style one or none: stigma simple or lobed. Fruit rarely a hard capsule; usually drupaceous, 2-5 celled, its outer portion or sarcocarp often splitting into valves. Seed solitary. Albumen none. Radicle straight, superior, next the hilum: cotyledons fleshy, or wrinkled and plaited.—Trees or shrubs abounding in balsam, gum, or resin. Leaves alternate, usually, not dotted, generally with stipules.

Affinities. Supposing the order broken up in the manner proposed by Brown, Lindley, Bartling, and others, then the various orders into which it is divided stand in a nearly equal relationship to each other. In addition to these affinities *Spondiaceae* associates, according to Lindley, with *Meliaceae* and *Aurantiaceae* in the imbricated æstivation of the calyx and in having more than four carpels, but are distinguished by their perigynous stamens: while *Burseraceae* are allied to *Rhamneae* in the valvate æstivation of their calyx and in having fewer than four carpels. *Anacardiaceae* and *Amyrideae* differ from each other the absence of pellucid or glandular dots in the leaves of the former, while they are present in the latter. By this last character *Amyrideae* associate with *Aurantiaceae, Rutaceae*, and *Zanthoxylaceae*, with which they are still further associated by their hypogynous stamens.

Geographical Distribution. The order in its most extended sense may be said to be of tropical origin, a few species only of *Pistacia* and *Rhus* being found in the south of Europe, in the warmer parts of North America and the Cape of Good Hope. Within the tropics, and in the warmer latitudes on either side, they are of frequent occurrence in Asia, Africa, and America; while a very few are met with in Australia. Of the number of genera enumerated by Meisner, excluding *Connaraceae*, amounting to about 65 (many of which are marked with a doubt as to their right to a place in it) the peninsular flora contains about 16 or quarter of the whole, and probably more will be found when the country is better explored. But of that long list of genera we have only 23 species, that is, including *Pegia*, which we have not introduced into our flora. Wallich's list is very imperfect as regards this order, including only about 25 species. Blume has 23 for Java, excluding *Zanthoxylaceae* which he includes in the order.

Properties and Uses. These are abundantly varied but for the most part dependent on

the Balsamic or acrid or even poisonous qualities of the resinous juices with which nearly the whole abound, and from which the order derives its name. To arrive at a clearer understanding of the properties of this extensive class it seems requisite in considering them, to treat separately of those of its different divisions.

Anacardieæ. To this suborder belongs *Semecarpus anacardium,* the well known marking nut of India. The juices of this tree are very acrid and injurious to those who work on the wood, while that of the nut applied to the skin causes inflammation and blisters. It is used as a remedy against Rheumatism and sprains. The receptacles of the fruit of *Anacardium ocidentale* or cashew-nut, are eat like apples, and the fruit itself after being freed from the acrid shell by burning, makes an moderately good substitute for almonds, and is very often used as such. The Mango also belongs to this tribe but does not require notice here, being generally well known. This fruit when freely used is said to excite boils and other inflammatory affections of the skin, but, so far as my own experience extends, I am disposed to attribute these ailments to the heat of the season rather than to the fruit, as I have seen hundreds of instances where they occurred during the hot season before a single Mango had been eat, and afterwards disappear when they were being largely consumed.

The *Rhus* or *Sumach* family have been long celebrated for their acrid poisonous properties. *R. toxicodendron* and *R. venenata* afford striking examples of these qualities. It is said that merely handling the leaves of the former is sufficient to cause a crop of vesicles, and exposure to the volutile emanations that take place from both trees has been known to excite in susceptible persons severe indisposition, or they have had their bodies covered with a crop of pustules. The two species of *Rhus,* natives of India, are not endowed with these acrid properties, at least I have never experienced any such effects though I have frequently been most freely exposed to and handled both, nor have I ever heard of any one being so affected by them. Notwithstanding these poisonous properties *R. toxicodendron* is a good deal used in medicine, especially in dropsical, and supposed Consumptive cases. *Stagmarea* a native of the eastern Islands, and *Holigarna* a native of Malabar, are said to possess similar properties, and these of a very acrid poisonous character. The juice of both is employed as a varnish or lacquer, that of the former is very much used by the Chinese and Japanese for varnishing all kinds of wooden articles, the elegance of which causes them to be dispersed to all parts of the world. The juice of the *Holigarna* is used for lacquering shields in Malabar. For a very full and interesting account of *Stagmarea* see " Companion to the Botanical Magazine, vol. 1 page 267-8." The juice of *Melanorrhaea* Wallich, so called from the dark coloured juice which exhudes from wounds in its bark, is employed for similar purposes in the Tenaserim provinces, a full account of which is given in Wallich's Plant: Asiat: Rariores: *Pistacia* the last genus which I shall mention, found in Syria and along the shores of the Mediterranean, affords from two of its species, *P. terebinthus* and *P. lentiscus,* the well known Cyprus turpentine, and still better and much more extensively used ' Gum Mastich,' so famed as a masticatory for whitening and preserving the teeth. From this slight enumeration, which does not nearly embrace the whole, it will be seen that this suborder includes a large proportion of interesting and useful trees.

Spondiaceæ. The fruit of *Spondias mangifera* is eatable—so is that of some of the West Indian species, where they have received the name of hog's plums. From wounds in the bark of *S. mangifera* a large quantity of a very pure gum flows, which is, I believe, collected and currently sold in the Bazaars as gum arabic, which it greatly resembles. In this product, this suborder differs widely from all the others of the order, and combined with its Botanical peculiarities goes far to justify its separation as a distinct order. Rheede, in Hortus Malabaricus, attributes many valuable properties to this tree which seem to be either imaginary or generally unknown, as I have never in a single instance heard of its being used medicinally. Roxburgh states that the young fruit is made into pickles, tarts, &c.

Burseraceæ. The products of this tribe are much more highly esteemed than those of either of the preceding—among those we find *Myrrh, Copaiva, Olibanum, Balm of Gilead, Frankincense,* &c. The fragrant unirritating balsamic qualities of all these substances, so very

remote from the acrimony of those, the produce of *Anacardiaceae*, mark these tribes as not very correctly associated in the same natural order, and go far to confirm the propriety of their separation not merely as tribes of one larger order, but as distinct orders. The Peninsular flora embraces several species of this tribe, some of them affording useful products. The resinous juice of both species of *Boswellia* is collected, and is used partly as frankincense and partly as pitch. That of *Canarium commune* has properties similar to *Copaiva*, while the kernels of the seed, on the other hand, afford by expression a bland edible oil. The *Canarium strictum* Roxb. is known in Malabar under the name of the black dammer tree, in contradistinction to the *Vateria* or white dammer. This tree is rather common in the alpine forests about Courtallum in the Tinnevelly district, and is there regularly rented for the sake of its dammer. The dammer is transparent and of a deep brownish yellow or amber colour when held between the eye and the light, but when adhering to the tree has a bright shining black appearance. The flowers of this species I have not seen, the fruit is a very hard, 3-celled, oval nut, tapering at each end.

Of the species of the genus *Protium*, of which the Peninsular flora embraces 4 or 5, I have not heard that any are in this country turned to a useful purpose. The three first in our list, to which the genus is now restricted, are all jungle trees, with soft very fragile wood, but so far as I recollect, never exhuding resinous juices—the fourth, *Balsamodendron* (Protium) *Gileadense* though a most common plant in some parts of the country, and constantly used for making fences, I found to be totally unknown here, as the plant producing the balm so highly esteemed and cherished, ' as one of the riches of Arabia.' This circumstance led me to suspect either, that the so-called plant of India was not the same species as the Abyssinian and Arabian one bearing the same name, or that some other plant produces the Balsam. Which of these was the more probable conjecture I was unable to say, but suspected the latter, as *Heudelotia*, an African genus, (proposed by the authors of the Flora Senegambiæ) but generically quite identical with *Balsamodendron*, though a common shrub in Senegal is not mentioned as affording Balsam. This question has been at length settled by Dr. Arnott, who has ascertained that the Indian and Arabian plants are not identical. Then the question now presents itself, is it desirable that we should attempt to introduce both the Myrrh and Balsam of Gilead plants since both are natives of the same tracts of country, and both afford produce of great commercial value ?

Remarks on Genera and Species. My recent collections have furnished me with what I consider a new species of *Semecarpus* and one of *Buchanania*, besides specimens of a plant referable to neither, nor to *Holigarna*, to which last however, in some respects, it appears allied. As I have not seen the flowers, and the fruit of *Pegia* is imperfectly described I am unable from my specimens to determine whether or not it is a species of that genus. It differs from *Holigarna*, to which it approaches in habit, and in having a fleshy, not bony, perecarp filled with minute cells : in having a superior not inferior fruit, with an erect, not pendulous seed, and in the embryo being situated at the base (next the calyx) of the fruit, not laterally and towards its apex. From *Semecarpus* it differs in wanting the bony perecarp and the enlarged torus. Under the impression that it may prove a *Pegia* I have subjoined the character of that genus as given by Meisner from Colebrooke, whose paper in the Linnæan transactions I have not an opportunity of consulting for myself.

The new (?) species of *Semecarpus* may possibly be the variety *S. cunifolius*, but if so I certainly think it a distinct species. The leaves are from 15 to 18 inches long, tapering nearly two-thirds of their length towards the base, the remaining third ending in an acute lanceolate point, hence they may be described as cuneato-lanceolate. Panicles of fruit (I have only seen the female plant) axillary and terminal, several congested near the apex of the branch, the lower half of the half grown perecarp embraced by the cup-shaped calyx, whether it afterwards enlarges I am unable to say, the young seed is lateral, pendulous from near the apex. The new species of *Buchanania* is at once distinguished by its coriaceous, even, glabrous, lanceolate, acute leaves, so accurately resembling those of the Mango, that but for the flowers I should at once have referred it to that genus. The fruit I have not seen. A leaf of the species of *Rhus* here figured was long ago represented by Burman (*Thesaur. Zeylan. table* 45) under the name of *Filix Zeylanicus Arborescens*, &c. but had never so far as I am aware been taken up by any author until Dr. Arnott and I described it in our Prodromus. I first found it at Courtallum and since in Ceylon.

SEMECARPUS.

S. Grahamii, (R. W. Icon. Pl. Ind. Ort. 235.) Leaves cuneato-lanceolate, acute, coriaceous, glabrous above, pubescent beneath, petiol short, furnished with 4 subulate bodies (as in *Holigarna longifolia*) panicles racemose, contracted, congested towards the summits of the branches: calyx truncated, cup-shaped, adnate, with the lower half of the young fruit: styles 3, lateral, near the apex, reflexed, stigmas capitate; ovary and young fruit covered with rusty colored hairs; ovule solitary, pendulous from the base of the styles.

I dedicate this species to the memory of my late highly esteemed correspondent John Graham, Esq. of Bombay, from whom I received along with many others, the specimen here described marked " 91, *Holigarna* or *Semecarpus*—a large tree called Biboo. It grows on the ghauts." In his premature removal science has lost an able and devoted votary, at a time too when diligently employed in the preparation and publication of a catalogue of the plants of the Bombay Presidency.

The genera *Semecarpus* and *Holigarna* are so nearly alike in their generic characters, in the earlier stages of fructification, that I cannot be surprised at the doubt he expressed as to its genus, as they are only distinguishable by the one having inferior the other superior fruit, which, at the period this one was gathered, is not so evident as in its more advanced stages.

BUCHANANIA.

B. lanceolata, (R. W. Icon. Pl. Ind. Ort. 237.) Leaves lanceolate, acute, or acuminate, quite entire, glabrous, congested towards the summits of the young shoots: panicles pubescent, erect, terminal and axillary from the summits of the branches, contracted: flowers small, numerous, capitate on the ends of the short lateral divisions of the panicle.

Malabar near Quilon.

I have not seen the fruit. The leaves are so like those of *Mangifera indica* that the same terms serve to characterize both.

PEGIA.

Gen. Char. Calyx persistent. Petals roundish. Disk annular, fleshy, embracing the ovary. Style 1, conical, stigma simple. Berry globose, 1-seeded.—*Meisner*.

This brief character is, I presume, copied from Colebrooke's paper in the Linnæan transactions. The original I do not possess the means of consulting; but it is too imperfect to admit of my referring with certainty the following plant to it, the more so as the habit is not given.

P. ? Colebrookiana, (R. W. Ic. Pl. Ind. Ort. 236.) Arboreous, leaves coriaceous, alternate, simple, oblong or obovate, quite entire, acute or ending in a short abrupt acumen, parallelly veined, glabrous, racemes axillary, or from the scars of fallen leaves, much shorter than the leaves, many-flowered. Fruit superior, globose, pointed with the persistent fleshy style and capitate stigma: perecarp containing between its laminæ numerous small cells, the base bound by a ring. Seed one, erect, cotyledons thick, fleshy, radicle inferior.

Hab.—*Shevagerry Hills.*

The leaves sometimes resemble those of some species of *Pterospermum*. They are usually broader above and some of them somewhat truncated at the apex, reticulated and villous beneath. The imperfect remains of the calyx in these specimens seem to indicate that it is 5-lobed, and several of the fruit retain the fleshy ring which originally bound the ovary.

BALSAMODENDRON.

The following remarks and characters I copy verbatim from Dr. Arnott's paper on this genus, published in the Annals of Natural History, vol. iii. p. 85-86.

" In the Prodromus Floræ Peninsulæ Indiæ Orientalis, i. p. 176, Dr. Wight and I united this, as a subgenus, to *Protium*, and it still appears to me doubtful if the two be separated by sufficiently important characters: the habit is, however, very different. In consequence of the addition of several new species, the character given by Dr. Wight and me, will require to be slightly altered, as follows:

Calyx late vel tubuloso-campanulatus: torus disciformis in fundo calycis ovarium cingens, externe inter singula stamina verrucula elevata instructus: stamina octo: drupa ovata: nux obtusa angulata.

From this it is obvious that the shape of the calyx and nut is not sufficient to distinguish *Balsamodendron* from the species we referred to the *Protium* of Burmann, and that the principal character consists in the position of the torus or disk.

All the East Indian species which I have seen have the calyx tubular-campanulate as in the Senegambia one, (*Heudelotia*) and *Commiphora* of Jacquein, while it is broad and shallow in *B. gileadense*, and perhaps in the other two from Arabia: but, as these last are not sufficiently known, I cannot avail myself of that probable difference of structure to subdivide the genus into sections. The following is a synopsis of all the species known.

1. *B. Berryi*, Arn. spinescens, foliis longiuscule petiolatis glabris, foliolis 3 cuneato-obovatis crenatis, terminali lateralibus duplo majore, pedicellis unifloris brevibus, petalis calyce breviter tubuloso subduplo longioribus, fructu apiculato.—Protium Gileadense. (*W. and A. Prod. Excl. syn.*) Amyris Gileadensis, Roxb. Fl. Ind. ii. p. 246. Exel. syn.

2. *B. Roxburghii*, Arn. spinescens, foliis petiolatis glabris, foliolis 3, terminali ovali serrulato, lateralibus minutis, pedicellis unifloris brevibus.—Amyris Commiphora.

3. *B. Wightii*, Arn. Spinescens, foliis sessilibus glabris, foliolis 3, subæqualibus cuneato-obovatis acute dentato-serratis, floribus sessilibus fasciculatis, fructu subiter acuminato.

* * * * * *

7. *B. Gileadense*, Kunth; inerme, foliis petiolatis glabris, foliolis 3, integerrimis obovato-oblongis, pedicellis brevibus unifloris, calyce latiuscule campanulato. B. Gileadense et B. opobalsamum.—*Kunth.*

EXPLANATION OF PLATE 75.

1. *Rhus decipiens.* Panicle and leaf—*natural size.*
2. An expanded flower seen from above, showing the petals and stamens inserted under the margin of the disk.
3. Stamens.
4. A detached petal.
5. The ovary somewhat advanced, cut vertically, ovules pendulous.
6. Ovary cut transversely, 2-celled.
7. A young fruit—*natural size.*
8. Somewhat magnified.
9. Cut transversely, one seed aborted or imperfect.
10. A fruit cut vertically.
11. A seed—*all, with the exceptions mentioned, more or less magnified.*

This plate is defective in not showing the character of the embryo—a point I overlooked when sending it to press.

EXPLANATION OF PLATE 76.

1 & 2. *Spondias Mangifera.* Leaves and panicle—*natural size.*
3. A dissected flower, petals and stamens removed, showing the disk as it encloses the ovaries.
4. Stamens.
5. Two ovaries removed and cut vertically, showing the pendulous ovules.
6. Cut transversely, showing the five carpels attached to a central axis.
7. A full grown fruit cut vertically.
8. Transversely.
9. A seed cut transversely.
10. A mature seed.
11. The same, the testa partially removed to show the cotyledons—*all more or less magnified.*

LV.—MORINGEÆ.

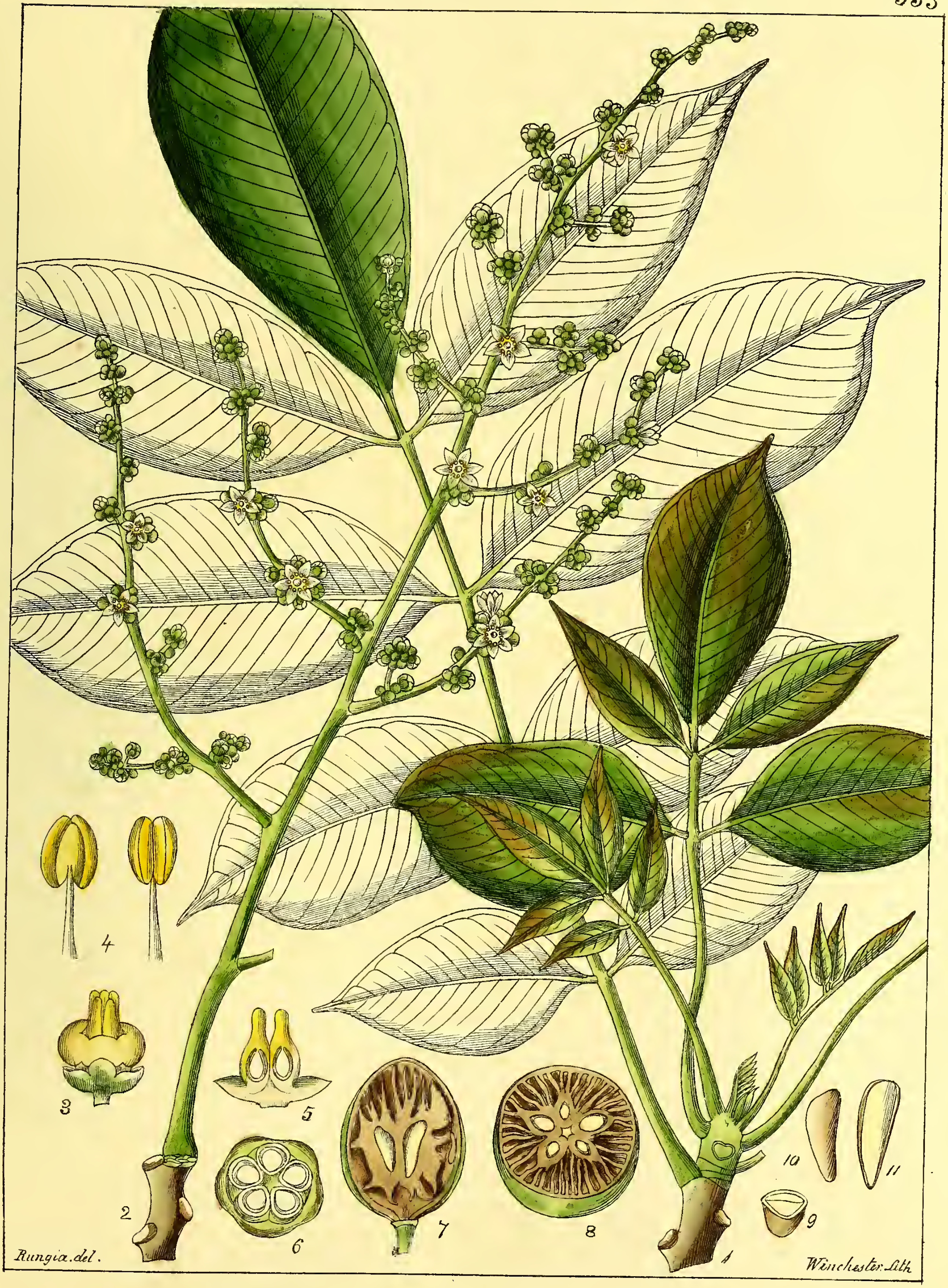
This is a small order consisting of one genus and about three species, long associated with *Leguminosæ* though sufficiently distinct, and so peculiar in its relations, that it is not yet determined where it should stand in the series of orders; the structure of the ovary placing it among the *Parietose* group near *Violarieæ,* while according to the flowers it is more justly referable to the tribe *Cæsalpineae* of *Leguminosae.* The characters derived from the latter as being the more conspicuous of the two, seem to have induced Botanists to prefer placing it near *Leguminosae,* the more so, as the habit still further associates it with that order.

" Calyx 5-partite: æstivation slightly imbricated. Petals 5, nearly equal, the upper one ascending. Stamens perigynous: filaments 10, flat, and hairy at the base: anthers 5 or 10, peltate, simple, 1-celled, with a thick convex connectivum. Torus fleshy, lining the tube of the calyx. Ovarium free, stipitate, 1-celled: style filiform, terminal, not obliquely inserted: stigma simple. Placentæ three, parietal. Fruit a pod-like capsule, 1-celled, 3-valved, loculicide. Seeds numerous, half buried in the fungous substance of the valves. Albumen none. Radicle straight, small: cotyledons fleshy, plano-convex.—Leaves twice or thrice pinnate, with an odd leaflet. Racemes panicled."

Affinities. As stated above, these are very obscure owing to the peculiar structure of the ovary, 1-celled, with three parietal placentæ, the fruit afterwards splitting into three valves. Arnott (Encyclopedia Britanica 7th edition) remarks " formerly considered as part of the *Leguminosae* but now separated by Mr. Brown. It seems however to have more affinity with these than with any others: nor do we see in the fruit very grave objections to such a supposition, as the flowers of *Gleditschia* have occasionally two carpels united in the same manner as the three of *Moringa.*"

On the correctness or otherwise of this view I can offer no opinion, being altogether unacquainted with *Gleditschia;* Lindley however holds an opposite opinion; he says " DeCandolle who did not overlook its anomalous structure as a leguminous plant, accounted for the compound nature of its fruit upon the supposition, that though unity of carpels is the normal structure of *Leguminosae,* yet the presence of more ovaries than one in a few instances in that order explained the constantly trilocular state of that of *Moringa.* To this however there are numerous and grave objections which cannot fail to strike every Botanist. What its proper station should be remains to be determined" again " Decaisne seems to think, it has more affinity with *Leguminosae* than with any other order." On these passages it may be observed, that it would have been more satisfactory had some of the grave objections been stated, since it is quite undeniable, that Messrs. DeCandolle, Arnott and Decaisne are all eminent Botanists

RHUS DECIPIENS. (W.&.A.:)



SPONDIAS MANGIFERA. (*Pers.*:)

Rungiah, del. Winchester Lith.

முருங்கைமரம் Mooringamaram

MORINGA PTERYGOSPERMA. (Gærtn.)

మునగమాను Moonagamanoo

G 9

and yet they do not seem to have been struck by them. While I thus object to such sweeping conclusions as the above, I confess I cannot help coinciding with Dr. Lindley in thinking, that the doctrine he opposes is pushed, in this instance, much too far by these authors, though I scarcely feel myself sufficiently master of the subject to join issue with them on this, one of the most difficult questions in Botany.

Geographical Distribution. India and Arabia are the native countries of these plants, but they are now introduced into the West Indies where they are cultivated for the sake of the very pure sweet oil with which their seeds abound.

Properties and Uses. The roots of *M. pterygosperma* are very pungent, and have the taste and peculiar flavour of horse radish in so eminent a degree, that any one unacquainted with it, would at once declare on tasting, that it really was that root, and as such, is very generally used by Europeans as a substitute. A little of the juice added to mustard so greatly augments its pungency, as almost to render it too much so for use and would, I should suppose, prove a very valuable adjunct to sinapisms in cases where it is desirable to render them unusually active. From wounds in the bark, a large quantity of gum exudes, agreeing in some of its properties with gum Tragacanth. Like it, it swells and softens in water, but does not form a fluid homogeneous mucilage like gum arabic, and is quite insoluble in alcohol. In this country both the leaves and capsules are used by the natives as pot-herbs, the latter being very generally introduced as an ingredient of their curries, on account of the peculiar flavour they communicate. The seed contains a large quantity of a very pure fixed oil, which in the West Indies is used as a salad oil. In the arts it is employed for lubricating delicate machinery, and is preferred by watch-makers to all others for oiling the machinery of clocks and watches, for which purpose, its non-liability to freeze at low temperatures greatly augments its value.

EXPLANATION OF PLATE 77.

1. Moringa pterygosperma—*natural size.*
2. A dissected flower—*natural size.*
3. Stamens and ovary, sepals and petals removed.
4. Anthers back and front views.
5. Petals detached.
6. Ovary pedicelled.
7. —— cut vertically, showing the parietal attachment of the ovules.
8. —— cut transversely, 1-celled.
9. A full grown capsule.
10. The same cut transversely, to show its 3 valves and winged seed *in situ.*
11. A detached seed.
12. The same cut transversely.
13. The cotyledons—*natural size.*
14. One of them showing the radicle at the base—*with the exceptions mentioned, all more or less magnified.*

LVI.—LEGUMINOSÆ.

With the exception of *Compositæ* this is the largest, in so far as the number of species is concerned, of any of the Dicotyledonous orders, and viewed in relation to its economical applications, I believe I may safely say, about the most important of the vegetable kingdom. Its species are found in every region from the Polar zones to the Equinox, flourishing equally amidst the snows of Lapland and Siberia, and exposed to the scorching heats of the tropics; floating in water, and on the most and arid plains of Asia and Africa. Its forms include almost every variety met with among Dicotyledonous plants, the most lowly herbs, and most stately trees, with all their intermediate gradations, being alike members of it. The foliage is equally variable, the leaves being either partially wanting, and their place supplied by enlarged stipules, or by dilated foot stalks; or they are simple, or present almost every variety of combination of those called compound, from the most simple combination of 2 leaflets half adhering together as in *Bauhinia,* up to the complexity of the form designated tripinnate. Turning from the foliage to the flowers we equally find almost every variety, regular and irregular, perfect and imperfect: bi or unisexual, petals absent or present: distinct, or united, regular and equal, or unequal and irregular, forming what is respectively called *Rosacious* and *Papilionaceous corollas.* The stamens in like manner are few or many, distinct or united into one or several bundles, the filaments usually all antheriferous, but sometimes part only bearing anthers. The female portion of the flower presents fewer irregularities, the ovary, with one or two, very rare exceptions, being 1-celled, that is composed of a single carpillary leaf, not of several as in most other Dicotyledonous plants. The fruit or legume however is most variable, and on that account affords excellent generic characters, being either one or many-seeded,

compressed or inflated; linear or variously contracted between the seed; continuous or jointed; dehiscent or indehiscent; membranous or woody; longitudinally one or 2-celled, or divided by transverse partitions, transversely many-celled; with or without enclosed pulp surrounding the seed. The seed like all other parts exhibit the same want of uniformity, they are either naked or imbedded in pulp, or sometimes furnished with an arillus or large caruncului; the embryo is either straight or curved along the edge of the cotyledons; the cotyledons are either thin and foliaceous or thick and fleshy, usually without, but occasionally furnished with a copious albumen as in *Fillæa*, and the section *Cathartocarpus* of *Cassia*. The only points on which they seem all to agree is in having the odd segments of the calyx anterior or remote from the axis. This is the only mark by which this order can always be distinguished from *Rosaceæ*, the fruit even, not being always leguminous, in one genus, *Detarium*, it is drupaceous.

If from Botanical, or structural peculiarities, we turn to properties we find similar variations. Among the arboreous forms the wood in some is of hardest and most durable description, witness some of the *Dalbergias* and *Acacias*, in others the very reverse is the case, as in *Erythrina* and *Agati*. Nearly the whole of the tribe *Papilionaceæ* afford edible nutritious grains, (beans, pease, in one word, pulse of all kinds) while the *Cassias* or *Cæsalpineas* are distinguished by the possession of both purgative and astringent properties, the leaves of Senna for example and the pulp which surrounds the seed of *Cassia fistula* being powerful purgatives, while the bark of *C. auriculata* is in constant use for tanning. Some of the *Mimosas* yield by boiling a powerfully astringent extract (catchu) while others, abound in the purest of gum, endowed with simply emolient or mucilaginous properties: gum arabic, gum tragacanth, and gum kino, though differing so widely from each other in their properties are all the produce of this order. From a species of *Alhagi* a kind of Manna is procured, while the leaves of *Agati grandiflora*, are bitter and tonic.

Such are a few of the anomalies and contradictions presented by this order, enough I presume to show the difficulty or rather impossibility of defining satisfactorily so polymorphous a tribe, and the necessity that exists, towards attaining a clear understanding of the whole, that its parts be considered in succession as if each formed a distinct order. This is the method followed by Bartling, who, adopting the divisions first marked out by Brown and extended by DeCandolle, has merely departed from their arrangement, in raising the suborders of these eminent Botanists to the rank of orders, perhaps an unnecessary innovation, but one which I intend partially to follow here, as enabling me to give a clearer exposition of the whole, and in less space, than if I attempted it in the mass. Before however proceeding to characterize in detail the suborders referable to the Indian flora I shall extract from DeCandolle's Prodromus, a table, (see below) presenting at one view, a clear and comprehen-

		SUBORDINES.			TRIBUS.
LEGUMINOSÆ.	CURVEMBRIÆ, nempè embryonis radiculâ super loborum commissuram inflexâ, seu Pleurorhizeæ.	PAPILIONACEÆ. Calycis lobi distincti. Stamina perigyna. Corolla papilionacea.	PHYLLOLOBAE seu cotyledonibus foliaceis.	Legumen continuum. Stamina libera.......	I. SOPHOREÆ.
				Legumen continuum. Stamina filamentis concreta............	II. LOTEÆ.
				Legumen transversè articulatum Stamina ferè semper inter se filamentis concreta. .	III. HEDYSAREÆ.
			SARCOLOBAE seu cotyledonibus crasso-carnosis.	Legumen polyspermum dehiscens. Folia cirrhosa, primordialia alterna.............	IV. VICIEÆ.
				Legumen polyspermum dehiscens. Folia non cirrhosa, primordialia opposita..........	V. PHASEOLEÆ.
				Legumen 1-2-spermum indehiscens. Folia non cirrhosa........	VI. DALBERGIEÆ.
		SWARTZIEÆ. Calycis vesicæformis lobi indistincti. Stamina hypogyna. Corolla o aut petalis paucis 1-2........			VII. SWARTZIEÆ.
	RECTEMBRIÆ, nempè embryonis radiculâ rectâ.	MIMOSEÆ. Sepala et petala antè explicationem valvata Stamina hypogyna...			VIII. MIMOSEÆ.
		CÆSALPINEÆ. Petala per æstivationem imbricata, staminaque perigyna.	Sepala et petala per æstivationem imbricata.	Stamina filamentis variè connexa............	IX. GEOFFREÆ.
				Stamina libera........	X. CASSIEÆ.
			Sepala antè explicationem indistincta. Calyx vesicæformis. Petala o..................		XI. DETARIEÆ.

sive arrangement of the whole order, showing its several suborders and tribes as developed in detail in his Memoirs and Prodromus. This distribution, has hitherto been adopted by all succeeding Botanists, but now I believe, in course of being somewhat modified by Mr. Bentham, (Labiatarum genera et species auctor) who lately published a Memoir entitled "*Commentationes de Leguminosarum generebus*" embracing however only a small portion of this vast family, but which, he informs me, is but the precursor of a complete revision of the whole order, similar to his work on the Labiatæ, a work, pronounced by universal consent a model of perfection in Botanical literature. Leaving for the present his views, not yet sufficiently developed to be touched upon here, I shall proceed to explain, as briefly as possible, the arrangement of DeCandolle which we have adopted in our Prodromus, after a few brief remarks on the affinities of the order, as a whole.

Affinities. Papilionaceous flowers and leguminous fruit will always mark any plant having them as a member of this order, many cases however occur where one or other of these marks are wanting, and some where both are absent, rendering it most difficult to distinguish by written characters this order from the section *Amygdaleae*, of *Rosaceae*. The *Mimoseae* have all regular flowers but at the same time bear leguminous fruit. The *Caesalpineae* have flowers which nearly approach the regular rosaceous forms; but they also have leguminous fruit. Hence no difficulty is there experienced but the *Detariums* are apetalous with a four lobed calyx and have drupaceous fruit. "Simple therefore as the diagnosis of the order usually is, Brown is perfectly correct in asserting that until he indicated the difference of the position of the odd lobe of the calyx in *Leguminosae* and *Rosaceae*, (§ *Amygdaleae*) no positive character had been discovered to distinguish the one from the other." And even this character in many cases can only be made out theoretically, since nothing is more common than the union of the two upper sepals leaving a 4-lobed calyx or one without any odd sepal, but then, the upper one in these cases is much larger than the opposed sepal. The drupaceous fruit in *Detarium* a leguminous genus, is thus explained by Dr. Lindley. "*Detarium* instead of a legume bears a fruit not distinguishable from a drupe. This last circumstance is easily to be understood if we bear in mind that a legume and a drupe differ more in name than in reality, the latter being formed on precisely the same plan as the former but with this modification, that its perecarp is thickened, more or less fleshy on the outside and stony on the inside, 1-seeded and indehiscent." The following remarks which I extract from Lindley's Natural System of Botany, merit careful consideration.

"In many respects this order is one of the most important which the Botanist can study, but especially as it serves to show how little real importance ought to be attached to dehiscence of fruit in determining the limits of natural orders. What may be called the normal fruit of *Leguminosae* is a legume, that is to say, a dry simple ovary, with a suture running along both its margins, so that at maturity it separates through the middle of each suture into two valves; but every conceivable degree of deviation from this type occurs: the *Arachis* and many more are indehiscent; *Detarium* is drupaceous; in *Carmichaelia* the valves separate from the suture, which remains entire, like the replum of *Cruciferae;* in all lomentaceous genera, such as *Ornithopus*, the valves are indehiscent in the line of the suture, but separate transversely; in *Entada* a combination of the peculiarities of *Carmichaelia* and *Lomentaceae* occurs; and, finally, in *Haematoxylon* the valves adhere by the suture and split along the axis. The divisions which have been proposed in this extensive order are of unequal value; it is possible that two of them, namely, *Mimoseae* and *Caesalpinieae* may deserve, as Brown seems to think, the rank of suborders; for they really appear to be of the same importance with reference to *Papilionaceae*, as *Amyridaceae*, *Connaraceae*, *Anacardiaceae*, and *Burseraceae*, with respect to each other."

DeCandolle divides the order into two principal sections, those namely in which the radicle is curved back on the commisure or margin of the cotyledons, *Curvembryæ* (Plates 78-79-81-82-84) and those in which the radicle is straight, *Rectembryæ* (Plates 80 and 82).

Curvembryæ are again divided into two suborders *Papilionaceæ* and *Swartzieæ*.

The *Papilionaceæ* are again divided into two sections, one distinguished by having thin almost foliaceous cotyledons, *Phyllolobeæ:* the other by having them thick and fleshy *Sarcolobeæ*. To the former of these subsections belong the tribes *Sophoreæ*, *Loteæ* and *Hedysareæ*, to the latter *Vicieae*, *Phasioleae*, and *Dalbergieae*. The suborder *Swartzieae*, being altogether of American origin are not noticed here. The *Rectembryæ* are in like manner divided into two

suborders *Mimoseae* and *Caesalpineae.* The former of these form a single tribe, *Mimoseae* the latter, is divided into three tribes, namely, *Geoffreae, Cassieae* and *Detarieae.* One species only of the first of these tribes is found in India, (the earth nut *Arachis hypogea*) and the third is altogether unknown here.

After this explanation I presume there can be no difficulty in understanding the table, which I prefer giving in the original Latin, after adding with, reference to the characters of the tribes, that "*folia cirrhosa*" alludes to the tendrils with which the leaves of many, the common garden pea for example, are furnished, and "*folia primordea*" to the first pair of leaves above the seed lobes, not to the seed lobes themselves, which might sometimes be mistaken for primordeal leaves in the *Phyllolobeae* tribes, as they ascend during germination and expand into leaf-like bodies. The cotyledons of *Sarcolobeae* rarely ascend in germination, and then can scarcely be mistaken for leaves owing to their thickness. It is to this section alone that characters taken from this organ are required, and even here, viewed as a means of assisting in the discrimination of genera, seem to be of little use, though, in a physiological point of view the peculiarity of alternate primordial leaves seems curious, as being confined to that tribe having tendril bearing leaves.

We now proceed to consider in succession the several suborders—commencing with the principal, both as to its extent and importance to mankind, namely.

Suborder—PAPILIONACEÆ.

This large suborder, which is scattered in greater or less profusion over every part of the known world, is composed of herbaceous plants, shrubs and trees. The leaves are usually alternate, unequally pinnate, or if abruptly pinnate, the rachis frequently terminating in a tendril in place of the odd leaflet, or they are digitate, or ternate or simple, from the abortion of the lateral leaflets, and occasionally though rarely, the leaf itself is altogether abortive and changed into a tendril, the large stipules then performing its functions, as in *Lathyrus aphaca.* Stipules lateral. Flowers bisexual, or, occasionally by abortion, unisexual, racemose, spiked, capitate, or panicled, pedicels bi-bracteolate. Calyx free, 5-cleft, lobes usually unequal, the two superior ones often cohering into an upper lip, the three inferior ones more or less united, forming the lower one. Torus expanded into a lamina covering the bottom of the calyx. Petals 5, very unequal, alternate, with lobes of the calyx unguiculate—the upper one, (*vixillum*) larger and overlapping the others in æstivation: the lateral ones (*alae*) usually unequal sided, the two lower ones often cohering nearly their whole length into one boat-shaped petal with a double claw, (*carina*) but sometimes altogether distinct. Stamens inserted with the petals, double their number, rarely all free, often all united into a tube surrounding the ovary, or, with 9 cohering, and the upper one, that next the axis, free, hence diadelphous (nine and one $\frac{9}{1}$) the more usual form: but sometimes they are equally diadelphous $\frac{5}{5}$, rarely tri-adelphous: the filaments distinct and subulate at the apex, anthers erect, 2-celled, sometimes by abortion 1-celled, ovary solitary, free, opposite the inferior lobe of the calyx, one or many-ovuled, ovules attached to the posterior suture, style one, stigma simple. Fruit, a legume, longitudinally 2-valved, 1-celled, or spuriously 2-celled, sometimes with contractions between the seed, or with transverse divisions separating at maturely into so many 1-seeded indehiscent cells, forming what is called a 'lomentum' (see plate 79). Perecarp usually double, fleshy externally, interiorly membranaceous or parchment-like. Seeds definite or indefinite, superposed, attached alternately to the valves, sometimes with a large caruncculus or imperfect arillus, the hilum marginal sometimes elongated. Cotyledons thin and foliaceous, ascending above the soil during germination, or thick and fleshy remaining below.

§ I. CURVEMBRYÆ—*Radicle of the embryo bent back on the edge of the cotyledons.*

PHYLLOLOBEÆ—Cotyledons foliaceous.

Tribe 1. SOPHOREÆ—Stamens distinct. Legume not jointed, frequently contracted between the seed. Cotyledons foliaceous during germination, suffruticose, or shrubby, rarely trees: leaves simple, ternate, or pinnate.

The Indian flora presents but few examples of this tribe *Sophora, Vigilia,* and *Edwardia,* (which I have recently found on the Balaghaut mountains) being the only ones known in the Peninsula. I do not find any useful properties assigned to the plants of this tribe.

Tribe 2. LOTEÆ—Stamens either all united, (monadelphous) or nine united and one free (diadelphous). Legume not jointed, 1-celled, or rarely imperfectly 2-celled, from one suture being intro flexed, sometimes with transverse septa. Cotyledons, flattish, foliaceous in germination.

This which is a large tribe, is divided into several subtribes—*Genisteae, Trifolieae, Clitorieae, Galegiae* and *Astragaleae*—species of each of these, except the last, occur in the Peninsula.

In this tribe we find many useful plants. In India the bark of some species of *Crotalaria*, (*C. retusa* and *juncea*) are employed as hemp in the manufacture of cordage and canvas. The powdered seed of *Fenugreck* (*Trigonella Fænum-grecum*) is very largely consumed in native cookery. The vegetable principle called Coumarin is found abundantly in the flowers of *Melilotus officinalis*, it is that principle to which the Tonka bean owes its properties. The young beans of *Cyamopsis psoraliodes* (Cott averaykay Tam) is with reason much prized by the natives as a culinary pulse, and merits more attention from Europeans, as it is a pleasant and delicate vegetable. *Indigofera tinctoria* and *anil* furnish us with the valuable blue dye (Indigo) of such vast commercial importance to India. The roots of *Clitoria ternatea* are emetic. The roots of *Tephrosia purpurea*, a most common plant, are bitter, and a decoction of them is prescribed by native practitioners in Dyspeptic complaints—many other species of this large Indian genus probably possess similar properties in even a higher degree. The leaves of *Sesbania Ægyptiaca* are in constant use among the natives as a poultice to promote supuration, and the wood makes excellent charcoal for the manufacture of gun-powder. The long slender pods of *Agate grandiflora* are eaten by the natives and the leaves are also prized by them. The tree grows rapidly but the wood is very soft and of little use. In addition to these, most of which are of Indian origin, many other plants of this tribe are in use in other countries, such as the numerous kinds of clover, lucern, &c. for fodder, and liquorice, laburnum, genesta, &c. as medicine and food.

Tribe 3. HEDYSAREÆ—Corolla papilionacious: Stamina either monadelphous or diadelphous (9-1 or sometimes 5-5) rarely all distinct, often somewhat persistent. Legume transversely divided into several 1-seeded cells or joints, sometimes 1-celled, and then always 1-seeded, cotyledons flattish, during germination somewhat foliaceous. The several-seeded genera are usually easily distinguished by their jointed pods separating at the joints into 1-seeded indehiscent cells: the one seeded ones, are not so easily distinguished, but they usually have the stamen tube more or less persistent.

This, as compared with the last is a small tribe, containing fewer genera and those of the Indian flora, with the exception of *Desmodium*, have but few species, neither are they important in their economical applications. The root of *Pueraria tuberosa* (which though placed by D.C. and others among *Lotiæ* really belongs to this tribe) peeled and bruised, is employed by the natives of the Circars as a poultice to reduce swellings of the joints: that of *Ormacarpum sennoides* is stimulant and tonic. Manna is said to be produced by *Alhagi Murorum* and several allied species in Persia and Bockra, but, though the plant is found in Egypt, Arabia, and India, it does not yield this substance, whence it is inferred, the former countries only are suited for its production. Few of the other species are esteemed of much value, *Saintfoin* (*Onobrychis sativa*) affords an excellent fodder and is much cultivated in different parts of Europe on that account.

SARCOLOBEÆ—Cotyledons thick and fleshy.

Tribe 4. VICIEÆ—Corolla papilionacious. Stamens diadelphous (9 and 1.) Legume continuous not jointed. Cotyledons thick, farinaceous, unchanged during germination and remaining under ground within the seed coat; radicle inflexed: leaves abruptly pinnated, except *Cicer* and some species of *Orobus*; the common petiol not jointed at the base with the stem, produced at the apex, except in the above instances and one or two others; into a bristle or tendril. Primordial leaves alternate.

This, though in respect of the number of its genera, a very small tribe yet contains some very useful plants. Among the most valuable of these may be mentioned the common pea

(Pisum sativum) the bean *(Faba vulgaris)* the tare or horse pea *(Vicia sativa)* the chick pea, Bengal or Chinna gram of this country, *(Cicer arietinum)* and the lintel *Eevum lens*, all of them being extensively employed as food for both man and cattle. The seed of some other species are considered poisonous, the seed of the bitter vetch *(Ervum ervillia,* D.C.*)* when mixed with flour and made into bread are said to produce weakness of the limbs, and horses fed on them become almost paralytic. The ripe seeds of the yellow vetchling *(Lathyrus aphaca)* are narcotic, producing intense headache if eaten abundantly, but when young like green peas, are harmless. The leaves of *Cicer arietinum* secrete an acid which the natives of India collect by spreading a cloth over-night on the plant and wringing out the dew in the morning. They then use it as vinegar, or for forming a cooling drink.

Tribe 5. PHASEOLEÆ—Corolla papilionacious. Stamens monadelphous or more usually diadelphous (9 and 1.) Legume several seeded, dehiscent, continuous, often with cellular rarely with coriaceous transverse partitions between the seed, not separating into joints. Radicle bent along the edge of the cotyledons. Cotyledons thick, unchanged by germination. Leaves usually trifoliolate, very rarely abruptly pinnated : primordial ones opposite.

This is a large tribe abounding in genera, many of which are extensively used as food, but more especially *Phaseolus, Dolichos* and *Lablab* (the old *Dolichos lablab*). Besides these many others are employed either for food or medicine and a few in the arts. The roots of the Coondoomunny *Abras precatorius* a common plant in this country, the beautiful black tipped bright red seeds of which are so generally admired, are sweet, resembling liquorice, for which they are used as a substitute, and an infusion of them prescribed as a diluent drink. The seed are in general use by native jewellers as a weight, and almost uniformly weigh exactly one grain troy. The young legumes as well as the seed of many species of *Phaseolus* or kidney bean are used as culinary vegetables ; among these are the French bean, the Haricot, our Duffin bean, *(Phaseolus lunatus)* as fodder, those of *P. aconitifolius, P. trilobus* and *radiatus*, are cultivated by the natives : the pease are used by them as food, and also given to their Cattle as gram, the last of these, and I believe *P. mungo* are indiscriminately used under the English name of " green-gram :" several species of *Dolichos* are also in use, but the best known of these is the common horse-gram or coultie *(D. uniflorus)* so extensively cultivated in this country.

Lablab vulgaris or avaraykai (*Dolichos lablab,* Lin. and Ainslie) is a very valuable pulse, and very generally much esteemed by all classes of natives who eat it, when young, pod and all as we do French beans, and when more advanced the beans only. In Mysore it is very extensively cultivated, fields on fields being seen covered with it towards the end of the year. The curiously-winged pods of *Psophocarpus* (Dolichos) *tetragonolobus* or Goa bean, (as it is called here) also afford a passable vegetable, so does the Sabre bean *(Canavalia gladiata)* the pods of which are sometimes 18 inches long. *Mucuna pruriens* and *M. prurita* both afford the well known Cowitch formerly not unfrequently used as an anthelmintic, another nearly allied species, the pods of which are unarmed with the stinging pickles of the last, and of the genus generally, is cultivated to a great extent in the Mauritius and Van Deman's land as a table vegetable, and also as fodder for cattle under the name of *Pois noire* or black bean. The pigeon pea or Doll *(Cajanus indicus* or *Cytisus cajan)* is very generally cultivated as a pulse in this country, and is highly esteemed by the natives. These are all herbaceous annuals or biennials ; but the beautiful flowered *Erythrina indica,* so conspicuous on account of its bright scarlet flowers, attains the size of a large tree, the light and soft wood of which is well known under the name of Mootchee wood, from being so much used by these toy makers, it is also generally used for constructing Catamarans, and the tree itself is employed as a prop for pepper vines.

Tribe 7. DALBERGIEÆ—Stamens variously combined. Legume one or several seeded, indehiscent. Cotyledons fleshy. Trees or shrubs, often twining. Leaves unequally pinnated, rarely trifoliolate, or reduced to a solitary leaflet.

In its properties this tribe is very different from the preceding. Here we find some of the largest trees, possessing wood of the hardest and most durable description, while others again, of the same genera, are twining shrubs, some of them most ornamental on account of the endless profusion of their beautiful white flowers, which contrast very favourably with their dark green foliage : among the most ornamental perhaps of the whole are the splendid Buteas—

B. frondosa and *superba*, further remarkable for producing a gum corresponding in its appearance and properties with kino. The seed of the former is much esteemed by the native practioners as an anthelmintic An infusion of the flowers of both these species dye cotton, previously prepared with alum, a bright yellow, which may be changed by an alkali into a deep redish orange. The lac insect is often found on its young branches. The Punga tree (*Pongamia* or *Dalbergia arborea*) is one of the most ornamental trees that grows, and the seed possess the rare property, in this family, of yielding to expression a fine fixed oil, to which the natives attribute valuable medicinal properties as an external application in irruptive diseases. The wood is white and appears close grained and firm, but is not so far as I am aware much esteemed by the joiner. Roxburgh however says it serves for a variety of economical purposes. The branches like those of many other Indian trees strike root readily when stuck in the ground, and cattle are fond of brousing on the leaves, hence it might be usefully employed as fodder.

The bark and flowers of our *Milletia piscidia*, (Galedupa piscidia, Roxb.) have the property, when powdered and thrown into water, of poisoning fish. *Dalbergia sissoo* affords a timber " tolerably light, and remarkably strong, but unfortunately not so durable as could be wished. It answers well for various economical purposes; the color is a light grayish brown, with darker coloured veins. Upon the whole I scarcely know any other tree that deserves more attention, for, when its rapid growth in almost every soil, its beauty, and uses are taken into account, few trees can be compared with it"—Roxb. *D. lalifolia* yields the much admired black wood so universally employed for making furniture. Roxburgh observes " on the Malabar coast this tree must grow to an immense size, as I have seen planks from thence full three feet and a half broad, and if we allow nine inches of white wood to have been on the outside of these trees the circumference must have been 15 feet exclusive of the bark." This is the Sit-sal of Bengal, but is not so heavy there as that on the Coast of Coromandel and Malabar. Some other species of this genus afford good timber. The only genus of this tribe that remains to be mentioned in this hasty review is *Pterocarpus*, that from which kino and the red Sandal or Saunders wood is derived. The species are all trees of considerable magnitude, and those I have seen of great beauty. From wounds in the bark of *P. Marsupium*, Roxburgh observes " there issues a red juice which hardens in the open air into a dark red, very brittle gummy resin, on being powdered it changes to a light brown not unlike powdered Peruvian bark. In the mouth it melts away like simple gum. Its taste is strongly but simply astringent as much so I think as that of the gum of the Butea, which it much resembles." It strikes a dark colour with a chalybeate. " The specimen of gum kino in the Banksean herbarium is perfectly like this. It is probable these are the same or very nearly allied" Roxb. From the *P. Santalinus* the red Sandalwood, a timber, chiefly employed by the dyers and colour manufactures, of the present day is obtained.

I have not myself heard of the timber of these trees being much used, and Roxburgh does not mention that of any except *P. dalbergioides*, which he says grows to an immense size, having seen planks 4 feet broad of coloured wood, exclusive of the outside white wood. He says it is not unlike Mahogany but rather redder, heavier, and coarser, in grain " that of the root is most beautifully variegated, I may say marbled, closer grained, and darker coloured." Ainslie states that Vayngie wood *P. bilobus* or *Marsupium*, (they are the same tree) is reckoned by the natives very useful " it is of a redish colour and is employed in making doors and windows, and for other common purposes." From the meagreness of these notices it would appear the wood of most of them is not much esteemed or is imperfectly known. With these brief remarks I close my account of this sub-order, but I trust enough has been said to show its importance though not to give an adequate idea of its value to mankind.

Sub-order Cæsalpineæ.

This sub-order consists for the most part of trees and shrubs, rarely herbaceous plants. Leaves abruptly pinnate, bi-pinnate or unequally pinnate, rarely simple or bifid, that is, composed of 2 leaflets united towards the base ; often furnished with peltate glands on the rachis : stipule, free or adnate to the petiol, sometimes armed. Flowers usually bisexual, sometimes unisexuas

irregular, for the most part racemose, large and handsome; the pedicels often furnished with bracteoles.

Calyx free, generally 5-cleft, imbricated in æstivation. Torus expanded, adnate to the cup of the calyx, terminating in a perigynous ring. Corolla more or less irregular, sometimes papilionaceous, more frequently the petals are free, expanding, or somewhat rosaceous, occasionally wanting, æstivation irregularly imbricative. Stamens more or less unequal, always perigynous; filaments rarely united. Ovary solitary, with several ovules. Legumes 1, or several, seeded, dehiscent, or rarely indehiscent, often transversely divided by cellular partitions, more rarely, by firm chartaceous laminæ (*Cathartocarpus.*) Seed usually compressed, sometimes horizontal, that is, with the edges not the sides of the cotyledons opposed to the valves, sometimes covered with pulp. Albumen usually wanting, but in *Cathartocarpus* copious, enclosing foliaceous cotyledons. Embryo straight, cotyledons usually large, plumule conspicuous.

Though for convenience, I have adopted this as a sub-order; it seems clear, from the complexity of structure observable among its genera, that it can scarcely as it now stands be admitted as such, since the only constant point of difference between it and *Papilionaceae* rests in its straight not curved embryo. The indehiscent cylindrical legumes, firm transverse partitions, and albuminous seed of the first section of *Cassia* (*Cathartocarpus*) point that out as a good genus, though it is to be wished it had a more euphonious name. This sub-order is divided into three tribes *Geoffreae, Cassieae* and *Detarieae.*

Tribe 8. Geoffreæ—Corolla papilionaceous or nearly so, stamens monadelphous or diadelphous, perigynous.

To this tribe only one Indian genus belongs, namely, *Arachis,* which, with the exception of the straight embryo has scarcely any affinity with it, being more properly referable to *Vicieae.* It is remarkable for maturing its seed under ground. At first the ovary is supported on a short stalk which afterwards elongates to several inches, in a downward direction, until it forces the ovary into the soil where it remains and ripens its seed. The plant is much cultivated on account of its seed, which, under the name of ground, or pig, nuts are roasted and eat like cushew-nuts which they much resemble in taste. They are besides oleagenous a rare occurrence in this order.

Cassieae.—Stamens distinct, or rarely monadelphous at the base (and then the corolla though not papilionaceous is irregular.)

To this tribe belong many very handsome trees and shrubs, some very useful ones, and many more that can scarcely be said to partake of either character. A few examples must suffice to illustrate the two first classes—which however I take indiscriminately without attempting to classify them.

Guilandina Bonduc or *Bonducella,* they are the same plant, is a handsome diffuse shrub armed with numerous prickles, forming an impenetrable fence. The globular very hard. Seed are intensely bitter and esteemed a powerful tonic. The infusion of them is said to be a very effectual remedy in cases of intermittent fever, and as such, has been recommended along with the extract of *Cocculus cordifolius* as a substitute for Peruvian bark, and as an excellent adjuvant in cases where the cinchona does not agree with the stomach. *Caesalpinea Sapan,* the red wood of commerce, is extensively exported from this country as a dye wood. *Hæmatoxylon Campechianum,* the logwood of commerce, is employed for similar purposes, and in habit the two trees are considerably alike. *Poinciana* is a genus much more remarkable for the splendour and beauty of its flowers than for any useful purpose to which it is turned. The gaudy princes feather or peacock's pride of this country (*Poinciana pulcheriena*) is everywhere met with, *P. elatior* with white flowers is, though less known, a finer plant, the tree itself being a very handsome one. Sir W. J. Hooker has figured in the Botanical Magazine one from Madagascar *P. regia,* more remarkable than either for the splendour of its flowers. *Pterolobium lacerans* a common jungle shrub of this country is curious on account of its legume, which is 1-seeded, ending in a knife-shaped wing. It is a most thorny plant well adapted for fences, but rather diffuse—*Parkinsonia, Hardwickia, Jonesia,* and *Humboldtia,* are all fine plants, but principally interesting on account of the celebrated persons whose names they bear. The Tamarind (*Tamarindus indica*) on the other hand, is most useful both on account of the value of its wood and fruit, but on these it is unnecessary to dwell. I may however mention

what is less generally known, that tamarind stones, reduced to fine powder and made into a thick paste with water, has the property, when merely smeared on the skin, of rapidly promoting suppuration in indolent, or what are called blind, boils. The same powder boiled into a paste with thin glue forms one of the strongest wood cements. *Cassia* is a very large genus containing some most useful plants, but generally its species are of little value under any point of view. The section *Cathartocarpus* all the species of which are trees and of great beauty, ought in my opinion to constitute a distinct genus as proposed by both Willdenow and Persoon, but reunited by DeCandolle. The flowers sufficiently correspond with those of the rest of the genus, but the cylindrical indehiscent legumes with hard transverse partitions and albuminous ! seed enveloped in pulp (for such they certainly are in *C. fistula, C. Roxburghii, C. bacillus* Roxb. also in *C. rhombifolia*, Roxb. (if distinct from *C. fistula*) all tend to their separation from the rest of the genus, and I cannot help remarking that were genera generally separated from each other by equally sufficient marks, we should have little reason to complain of excessive multification of them which is not always the case now. The sweet pulp which envelopes the seed of *C. fistula* is a powerful but mild aperient, a small quantity producing the effect, it further possesses the property of colouring the urine of a deep brown colour, a fact, of which patients requiring to use it habitually, ought to be warned, as I have known such refuse to take it, on the supposition that it had a tendency to heat the system and excite a bilious habit, even when doing them much good. To what extent the other species enjoy this property I am unable to say, in *C. rhombifolia* Roxb. the pulp is bitter. None of the species of true *Cassia*, have equally pulpy legumes, hence it is not to be expected that they should possess similar virtues, but cathartic properties of great energy are found in the leaves of several, more especially of those belonging to the section *Senna,* all of which are readily distinguished by their very compressed falcate legumes. Of these, the *Cassia* (Senna) *lanceolata* and *C. elongata* are the most important, several millions of pounds weight of the dried leaves being annually consumed in Europe, exclusive of what is used in this and their native countries Egypt and Arabia. *C. obtusa* a procumbent plant common in this country is used by the natives for similar purposes. Dr. Lindley considers the *C. lanceolata* of Royle's Illustrations and of our Prodromus, which are the same plant, distinct from the true *C. lanceolata* of Forskahl and names it *C. elongata.* He remarks of it, " the dried leaves form the finest Senna of commerce known by the name of Tinnevelly Senna" under " *C. lanceolata* Forsk" he describes a species differing from ours in having a sessile gland above the base of the petiol, and pods, linear, villous, compressed, incurved : to this species he appends the following note.

" As this sheet was about to be printed off I was so fortunate as to meet with the *C. lanceolata* of Forskahl, in a collection of Arabian plants (No. 71) collected by Dr. S. Fischer, in palm grounds in the valley of Fatmé, flowering at the end of February. The leaflets are in 4 or 5 pairs, never more ; oblong, and either acute or obtuse, not at all ovate or lanceolate, and perfectly free from downiness even when young; the petiols have *constantly* a small round brown gland a little above the base. The pods are erect, oblong, tapering to the base, obtuse, turgid, mucronate, rather falcate, especially when young, at which time they are sparingly covered with coarse scattered hairs. The species is therefore quite distinct from *C. elongata,* as I at first supposed ; and consequently, excellent as the Tinnevelly Senna is, a sort of still finer quality may be expected from India, as soon as this, the true Senna of Mecca shall have been introduced into the Peninsula."

A variety of other species of this genus are recorded as possessing medical or other useful properties, but of these I shall only mention *C. auriculata*, the bark of which is constantly used for tanning and *C. sophora* and *C. alata*, the latter much cultivated in gardens in this country as an ornamental plant, the juice of the leaves of both of which is considered a sovereign remedy against ringworm and other similar herpetic eruptions,* a virtue which I am much disposed to doubt. *Cassia alata* is easily known by its pods being apparently nearly square through the valves winged on the back.

* I may here mention that the leaves of the Margosa tree *Azadirachta indica,* which in native practice have been long used as a remedy against pustular eruptions, have recently been tried to a great extent by a medical officer, and found a most efficient application. He reduces the leaves to a pulp by beating them in a mortar, they are then fit for use. Applied in this form he says they act like a charm in removing the most intractable forms of *Psora* and other pustular eruptions.

The genus *Cynometra* affords the fruit known and much esteemed in the eastern Islands under the name of Nam-nam *(C. cauliflora)* but which is scarcely known in this country, where, though described as a native plant, I suspect it is introduced. It is growing in the spice gardens of Courtallum but I have never met with it wild. Those I saw are introduced. *C. ramiflora* is certainly a native of Ceylon, from which I have been favoured with fine specimens by Colonel Walker, it seems equally a native of Malabar as it is figured by Rheede.

The last genus of this sub-order to which I shall allude is *Bauhinia*, a genus named in honor of the brothers John and Caspar Bauhin, two celebrated Botanists of the last century, and considered by Linnæus most appropriately dedicated to them on account of the two lobed leaves or more properly two twin leaflets of a compound leaf, partially united, giving them the appearance of a simple two cleft leaf.

This genus abounds in species, many of them very handsome small trees or large shrubs, some are scandent. *B. malabarica* grows to sufficient size to be used as timber tree in Malabar. *B. racemosa (parvaflora* Roxb.) a rather common shrub or small tree in India, yields a thick bark of which matchlock-men make their matches. "It burns long and slowly without the help of saltpetre or any other combustible. To prepare the bark it is boiled, dried and beat. Ropes are also made of the inner rind which is fibrous, strong and durable (Roxb.)" *B. Vahlii*, W. and A. (*B. racemosa*, Vahl. and Roxb. not Lam.) is one of the largest species of the genus, "the largest and most extensive creeper I have ever seen" Roxb.—a native of alpine districts.

The leaves are often a foot each way and in the northern districts of the Circars are collected in quantities great and sold in the bazaars for various purposes, plates, package, &c. The seeds are eaten raw, when ripe the taste is like that of cashew-nuts. *B. anguina* is another extensive creeper remarkable for having its stem and branches compressed, that is several inches broad and not half an inch thick, it is believed by the natives of Silhet to be a charm against snakes and other venomous reptiles.

Here I conclude my very imperfect sketch of this sub-order remarkable for containing many both valuable and curious plants.

Sub-order Mimoseae.

This is a large sub-order, consisting principally of tropical plants, or, with very few exceptions, confined to the warmer regions on either side the tropics.

The species are either trees, shrubs or herbaceous plants, the former often armed with spines or prickles. The leaves are alternate, abruptly pinnate, or bi or tri-pinnate, the pinnæ and leaflets opposite, often remarkably sensitive, shrinking from the slightest touch. Petiols often glanduliferous, sometimes becoming dilated and foliaceous on the abortion of the leaflets.

Flowers regular or nearly so, often polygamous, rarely all bi-sexual; sepals 4 5, equal, often combined into a 4-5 toothed calyx: æstivation valvular or very rarely imbricative. Petals 4-5, equal, usually hypogynous, rarely inserted into the bottom of the calyx, sometimes distinct, sometimes all more or less united: æstivation valvular or rarely imbricative. Stamens inserted with the petals, distinct or monadelphous, as many, or several times as many as the petals. Embryo straight, the radicle never being bent along the lobes of the cotyledons: cotyledons usually foliaceous, very rarely enclosed in albumen. Podosperm usually flexuose or twisted.

This sub-order is very distinct from the two preceding ones, especially in the character of its flowers, which are here regular, usually approaching to tubular, with valvate æstivation and generally hypogynous stamens. The legumes are very various in their forms, and afford excellent generic characters. In *Entada* and *Mimosa*, they are jointed or separate transversely as in the *Hedysareae*, in *Inga* and *Adenanthera* they are long and often remarkably contorted towards maturity, the want of which character, combined with its very thick hard woody valves, renders questionable the propriety of referring *I. Xylocarpa* to that genus. The legumes of *Acacia* are sufficiently various to afford good specific characters, in most they are linear and much compressed but in *A. arabica*, they are remarkably contracted between the seed. A large proportion of the species of this order are arboreous, but others are minute herbs, and one Indian species (*Desmanthus natans*) is almost constantly found floating on water, as its name implies, or growing on the muddy banks of tanks or ditches.

Considerable variety is also observed in the character of its products. The wood of most of the arboreous species of *Acacia* is exceeding hard, close grained and heavy, while that of *Parkia biglandulosa* is comparatively soft and coarse grained. That of *Acacia speciosa* is so intensely hard that it is with difficulty it can be cut with the handsaw. The wood of many is dark brown or nearly black in the centre. Many of the species yield very pure gum, from *Acacia vera* and *Arabica,* the finest gum arabic is procured. The bark of others is strongly astringent, some of them yielding the *Catechu* extract, among these may be mentioned *A. ferrugenea, A. catechu,* and *A. leucocephala.* From the bark of all of these, fermented with jaggery, an inferior kind of arrack is procured by distillation ; they might all be more usefully employed in tanning leather. The bark of one New Holland species *A. melanoxylon* is imported into England in considerable quantities for that purpose. Of this bark in 1831, there was 39 264 cwt. shipped from Hobart Town for England, and in 1835, the value of bark exported from the same place, was nearly £12,000. This subject therefore seems to merit attention in this country where so many species of the genus, having astringent bark, are indigenous. The bark of some of the species of *Inga* is also very astringent but do not seem to be known as such in this country. Here the *Inga dulcis* or *Koorkapilly* (see Icon. Pl. Ind. Or. No. 198) is much employed as a fence, under the English name of ' white thorn' though a very different plant.

Remarks on Genera and Species. This branch of the subject I regret to say I must leave nearly untouched, as the space I can now devote to it, is so inadequate to its extent. This however I less regret as a high authority (G. Bentham, Esq) has declared the exposition of the Indian portion of the order, in our Prodromus, the most valuable work on *Leguminosae* that has appeared since the publication of DeCandolle's Prodromus. To that therefore I refer for all we then knew. Some new genera and several species have been added, but as these might require, properly to elucidate them, probably little short of a whole number and weeks of laborious application for their careful determination I must for the present leave them undetermined. To compensate however so far as I am able for this deficiency, I shall make a point of devoting several plates in each number of my Icones for some time, to the illustration of the order; in that work a considerable number of species have been already figured, and as the current number (No. 13) will contain several more, I beg leave to refer to it, contenting myself for the present, with subjoining the generic character of one new genus and of *Edwardsia* and *Taverniera,* two old genera, but only recently added to the Peninsular flora.

EDWARDSIA, Salisbury.
Sub-order Sophoreæ.

Calyx inflated-campanulate, obliquely truncated, obscurely 5-toothed. Corolla papilionaceous, vixillum somewhat shorter than the wings, shortly unguiculate, broadly obovate, emarginate, angled at the base. Wings oblong, unguiculate, narrow, or scarcely auricled at the base: keel longer than the wings, obtuse, straight, somewhat united below, free at the apex. Stamens free, filaments glabrous, slightly dilated. Ovary shortly stipitate, linear, with several ovules. Style slightly incurved, glabrous, dilated at the base, attenuated at the apex. Stigma thin. Legume moniliform, 1-celled, 2-valved, many-seeded, 4-winged. Seed roundish, estrophiolate, radicle somewhat incurved.

Trees or shrubs usually from the Antarctic regions. Leaves exstipulate, unequally pinnated, many-paired, the terminal leaflet distant from the last pair. Inflorescence racemose, racemes axillary, lax, few-flowered. Pedicels one-flowered, ebractiolate, or with a subulate bractea.

The essential character of this genus consists in the longitudinally winged legume, combined with the characters of the sub-order *Sophora.* As my specimens have the habit of *Sophora* and possess the character taken from the legume well developed, I can have no doubt of their really belonging to this genus though not in flower The species I cannot so well determine. It may be new, but looks as if it might be referred, in so far as characters taken from the foliage only can be relied upon, without much violence to either *E. nitida,* or *E. denudata,* but preferably to the last owing to the leaves being nearly glabrous.

Taverniera D.C.—Tribe *Hedysareæ.*

Calyx bi-bracteolate at the base, 5-cleft, sub-bilabiate, segments linear, lanceolate, acuminate. Corolla papilionaceous, vixillum, somewhat obovate, wings small, about half the length of the other petals, keel obtuse, or obliquely truncated. Stamens 10, diadelphous (9 and 1) straight or inflexed. Style filiform, long, flexuose, deciduous, ovary 2-ovuled: legume flat, consisting of two 1-seeded, joints, the lower joint sometimes abortive, stipitiform, the fertile one oval, or orbicular, aculiate, or prickled, the sutures on both sides convex.—Suffruticose oriental, or Indian plants.

Leaves 1-3 foliolate—Stipules united at the base, flowers rosy coloured or white, afterwards scariose and sub-persistent.

T. cuneifolia, (Arn.) Leaves one foliolate, petioled, the upper ones aborting, the leaflet cuniato-obovate, recurvedly mucronate, thickish, glabrous or pubescent: peduncles short from the axils of leafless stipules, bearing towards the apex, from 1 to 4 shortly pedicellate flowers. The legumes with the inferior joint abortive, stipitiform, the superior one unequally obovate, echinate, with rigid hooked bristles.—*Hedysarum cuneifolium,* Roxb. *Onobrychis cuneifolia,* D.C.

This species, which seems rare in India, has only, so far as I am aware been found in Mysore. It is readily known by its prickly fruit, being the only Indian species of the tribe *Hedysareæ* having that character.

ACROCARPUS, (R. W.) Arn.

Calyx sub-coriaceous, ebracteolate, campanulate, 5-cleft, segments erect, the superior and inferior a little larger. Torus covering the tube: Petals oblong, sub-coriaceous, about equal, sessile, long persistent, inserted on the mouth of the calyx and a little longer than its lobes; æstivation sub-imbricate: Stamens alternate with the petals, filaments broad at the base, subulate, two or three times longer than the petals, straight; anthers oscillatory. Ovary long, stipitate, (stipe free) oblong, linear, falcate, pointed, with the short incurved acute style, many (about 15) ovuled. Fruit unknown.

This species is a large showy tree. The trunk of one that I saw, I estimated at 50 feet high without a branch. Leaves alternate, unequally pinnate, deciduous; petioles 4-6 inches, long, round: leaflets 3-4 pairs, lanceolate, acuminated, somewhat unequal at the base, 2-3 inches long, entire, pale beneath. The flowers largish, expanding before the evolution of the leaves, scarlet racemose. Racemes speciform, 6-8 inches, long, thickly covered with flowers, the pedicels a line or line and half long, recurved. Stamina nearly an inch long.

A. fraxinifolius, Arn.—Journal of Zoology and Botany No. 12 Wight's Icones Pl. Ind. Or. tab. 254.

Habitat.—The forests of Courtallum flowering in February when almost naked of leaves. In this respect resembling the *Erythrinas*.

The affinities of this genus in the order are not yet clearly made out for want of fruit, but Dr. Arnott thinks it referable to the tribe *Cassieæ* of *Cæsalpineæ*.

EXPLANATION OF PLATES.

78* (81)—1. *Virgilia aurea*, (Lam.) Flowering branch, *natural size.*

2. A dissected flower. The stamens in this figure are incorrectly represented diadelphous: they ought to have been shown monadelphous at the base and free above.

3. Anthers back and front views.

4. Ovary cut vertically.

5. A cluster of pods full grown—*natural size.*

6. A seed *in situ* and 7. The same detached—*natural size.*

8. A seed cut vertically, showing the incurved radicle of *Curvembryæ.*

9. The cotyledons removed from the testa—*with the exceptions mentioned, all more or less magnified.*

79 (82)—1. *Tephrosia suberosa,* (D.C.) Flowering branch—*natural size.*

2. A dissected flower, stamens diadelphous.

3. Stamens back and front views.

4. A portion of the ovary cut vertically.

5. A portion of a legume opened to show the seed *in situ.*

6. A seed—*natural size*—7 and 8. The same dissected.

80 (79)—1. *Desmodium rufescens.* Flowering branch, *natural size.*

2-3. A dissected flower, petals detached from the ovary and calyx.

4. Anthers back and front views.

5. Ovary cut vertically.

6. A portion of a legume showing its jointed structure, two of the cells opened to show the seed *in situ.*

7-8. Dissected seed.

9. A portion of a leaf to show the hairs—*all more or less magnified.*

81 (84)—1. *Cyanospermum tomentosum,* (W. and A.) Flowering branch—*natural size.*

2. A flower partially dissected—the lobes of the calyx removed to show the insertion of the petals, stamens and ovary.

3. Anthers back and front views.

4. The ovary opened, 2-ovuled.

5. A legume opened, 2-seeded, seed blue (hence the generic name).

6. A detached seed.

7. The same cut transversely.

8. Seed cut vertically, to show the curved embryo.

9. Cotyledons removed from the testa—*all more or less magnified.*

82 (78)—1. *Pterocarpus Wallichii,* (W. and A.) Flowering branch—*natural size.*

2. A dissected flower.

3. Stamens.

4-5. Ovary cut vertically and transversely.

6. A legume.

7. The same cut vertically, 2-celled and 2-seeded, showing that half the ovules have aborted.

8-9-10. A seed dissected—*all more or less magnified.*

83 (83)—1. *Cassia Roxburghii,* (D.C.) Flowering branch—*natural size.*

2. Calyx, stamens, and ovary, *in situ*—filaments not united.

3. The petals detached nearly regular.

4-5-6. Anthers of different forms.

7-8. Ovary cut transversely and longitudinally.

9. Portions of a legume, cylindrical, with its transverse division.

10. Another portion with a seed *in situ.*

11. A seed—*natural size.*

12. The same cut transversely, showing the foliaceous cotyledons and copious albumen by which they are surrounded.

84 (80)—1. *Adinanthera pavonina,* (Linn.) Flowering branch—*natural size.*

2. A flower expanded.

3. The same, the petals removed to show the calyx, stamens and ovary.

4. Anthers, showing the glandular appendage whence the generic name is derived.

5-6. The ovary cut transversely and vertically.

7. A legume as it appears during dehiscence.

8. A seed.

9. Cut vertically, to show the radicle and plumula.

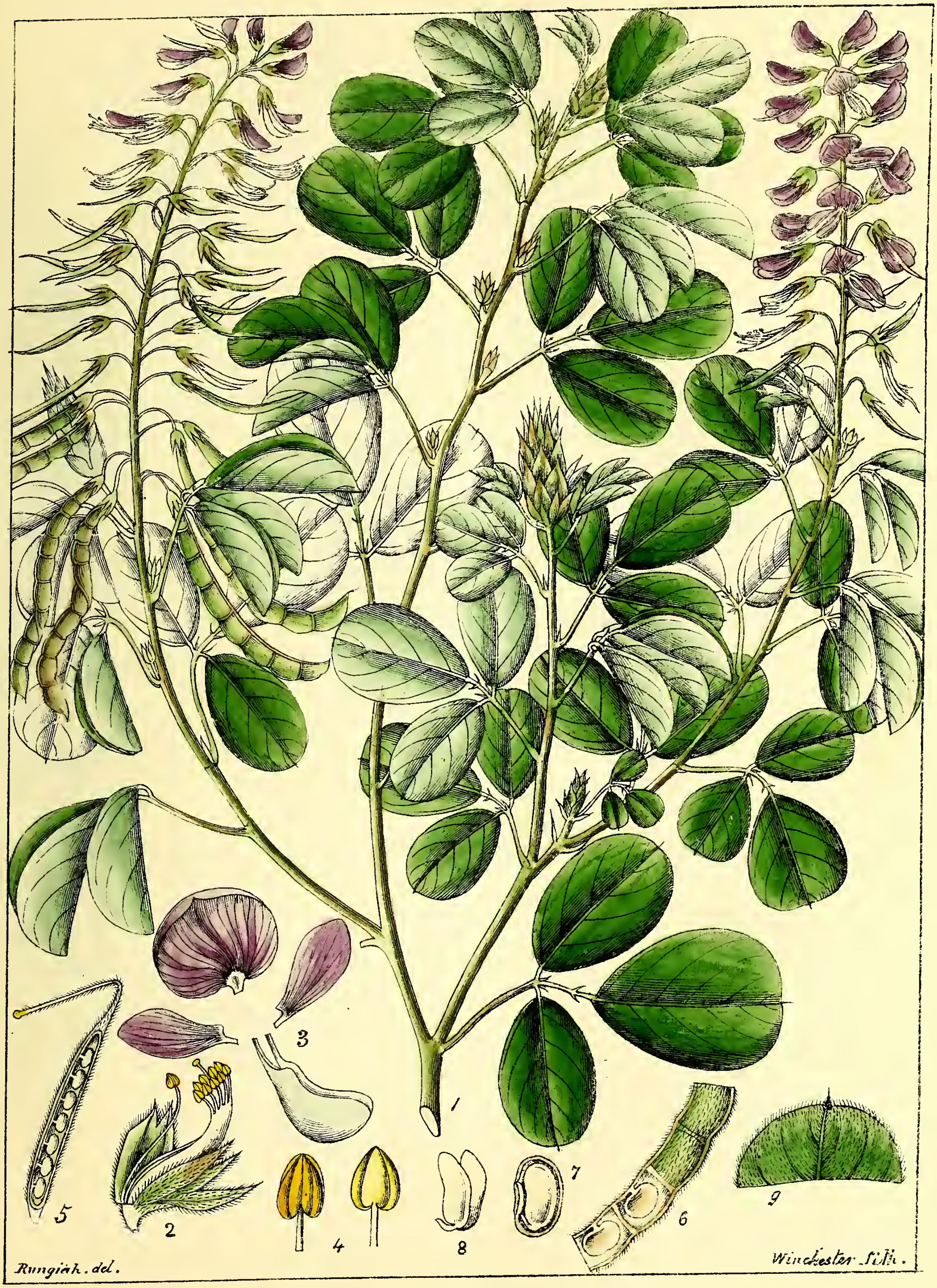
10. Cut transversely.

11. Embryo detached.

* Owing to an oversight in numbering the plates of this tribe they are erroneously arranged: with the view of enabling the error to be corrected in binding, I have numbered the explanations as they should stand in the series.

VIRGILIA AUREA. (Lam.)

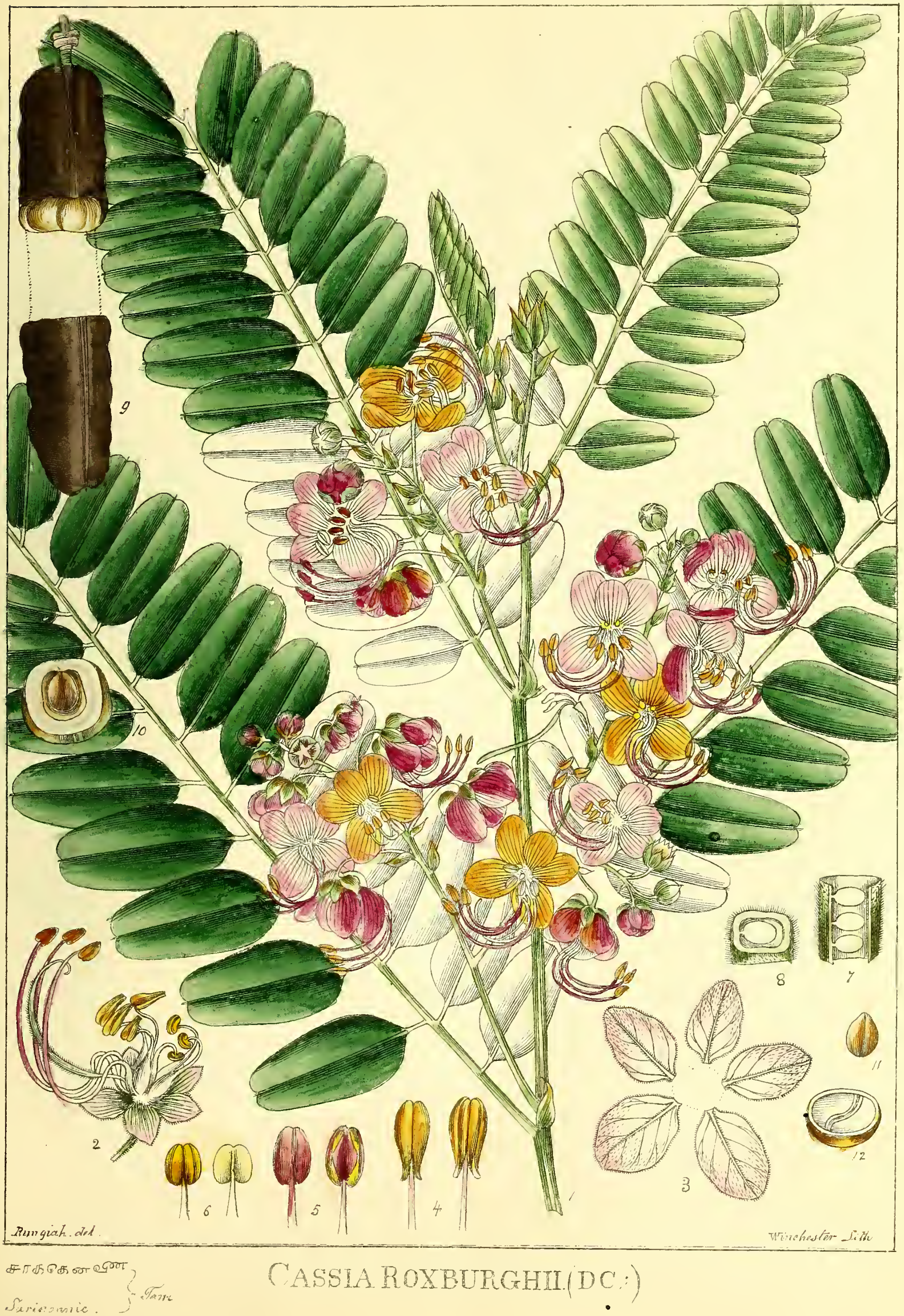
TEPHROSIA SUBEROSA. (DC.)



DESMODIUM RUFESCENS. (DC.)

Bungiah del. Winchester Lith.

PTEROCARPUS WALLICHII (W. & A.:)



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CASSIA ROXBURGHII (DC.)

ADENANTHERA PAVONINA. (Linn.)

LVII.—ROSACEÆ.

In extra tropical Botany this is a most important order, but within the tropics of very secondary consideration, owing to the small number and inferior value of its tropical species. In Europe and the temperate regions of Asia and America they abound, and those of the former countries supply us with nearly all our finest fruits. The order is divided into different sections or sub-orders. To *Potentillae* belong strawberries and raspberries: roses to *Roseae:* cherries, plums, peaches, nectarines, apricots and almonds to *Amygdaleae:* apples, pears, quinces, medlars, and the fragrant hawthorn, in all their endless varieties to *Pomeae.* This, therefore, like *Leguminosae,* as the preceding enumeration of tribes will show, is a very polymorphous order, and not easily reducible within the limits of a definition, however extended, and like it, has been divided by some into tribes, by others into sub-orders with detailed characters, and lastly, by Bartling and G. Don into several distinct orders. DeCandolle retains them as one, gives the following character of the whole order, but I fear that, in doubtful cases, it would scarcely enable one with certainty to determine whether the plant under examination really belonged to this order: as however such examples are not of frequent occurrence, it being easier to recognize than to define the order I give it nearly as he does.

Sepals usually 5, more or less combined into a tube and thence 5-lobed, generally persisting, free, or adherent with the ovary. Petals of the same number, rarely wanting, inserted upon the calyx; æstivation imbricated, mostly regular. Stamens inserted with the petals, usually indefinite; filaments with an incurved æstivation; anthers 2-celled, opening longitudinally. Carpels numerous, sometimes reduced and solitary, sometimes united among themselves or with the tube of the calyx, apparently forming one ovarium. Ovaries 1-celled, style simple, dilated upwards into variously formed stigmas, frequently lateral, distinct, or rarely combined. Seeds one or two, rarely more in each carpel, erect, or inverted, exalbuminous (except in *Neillea* and *Hirtella*). Embryo straight. Cotyledons leafy or fleshy—Herbs or trees. Leaves alternate, simple, or compound, with 2 stipules at the base. Inflorescence various.

To understand this character fully some study is required. Carpels numerous, applies to the fruit of the raspberry, strawberry, rose &c., which is made up of a congeries of small carpels, each having its own style and stigma, and each except in the rose becoming a drupe in miniature, that is, a soft juicy or pulpy fruit, with a single hard stone in the centre. The sloe, and its numerous cultivated varieties, (plums of all kinds) the cherry, the almond, the peach, the apricot &c., belong to the reduced and solitary forms. To the first of these divisions, carpels numerous, belong the tribe *Dryadeae* or *Potentilleae,* the second, carpels reduced, applies to *Amygdaleae.* The third set, those namely, having the ovaries united among themselves or with the tube of the calyx embraces the *Pomaceae* or apple tribe, which has 5 one-celled ovaries, all united with the fleshy calyx, by which they are enclosed, and finally become a single fleshy succulent fruit. In the Rose the carpels are numerous, enclosed within the fleshy tube of the calyx, which, is contracted at the apex and as it approaches maturity finally becomes nearly a shut sac, and may almost be compared to a berry, except that the seed are not enveloped in pulp, as in the gooseberry. The carpels are inserted into the tube of the calyx and the long slender style projects beyond the orifice. Notwithstanding the very remarkable difference between the fruit of a rose and a strawberry they are yet placed to the same division of the order, namely, *Rosaceae* proper. This may be explained by comparing the calyx of both to a purse; in the rose the seed are attached to the bottom inside and enclosed by it; while in the strawberry it is as it were inverted, pushing the carpels beyond the mouth, that is, the ring of the calyx, and allowing them to ripen exposed to the air and light. (See Icones Nos. 38 and 230, *Rosa* and *Rubus*) The fleshy edible part of the apple, pear, quince &c., is the thickened fleshy tube of the calyx.

Having premised these general explanations of the structure of the fruit of the order as a whole, I shall now transcribe Dr. Lindley's characters of *Rosaceae* and the three sub-orders into which he divides this tribe, namely, *Pomaceae, Amygdaleae* and *Sangesorbeae,* adding under each, the properties, appertaining to it.

ROSACEAE. The Rose tribe.

" *Calyx* 4 or 5-lobed, with a disk either linening the tube or surrounding the orifice; the fifth lobe next the axis. *Petals* 5, perigynous, equal. *Stamens* indefinite, arising from the calyx, just within the petals, in æstivation curved inwards; *anthers* innate, 2-celled, bursting longitudinally. *Ovaries* superior, either solitary or several, 1-celled, sometimes cohering into a plurilocular pistil; *ovules* 2, or more, suspended, very rarely erect; *styles* lateral; stigmas usually simple, and emarginate on one side. Fruit either 1-seeded nuts, or acini, or follicles containing several seeds. *Seeds* suspended, rarely ascending. *Embryo* straight, with a taper short radicle pointing to the hilum, and flat cotyledons. Albumen usually almost obliterated when the seeds are ripe; if present fleshy.—*Herbaceous* plants or *shrubs*. Leaves simple or compound, alternate, usually with 2 stipules at their base."

Under this order Dr. Lindley ranges the rose, the raspberry, bramble, and strawberry, the Dryas and Agrimony, meadow sweet (*Spiræa*) and many others in which numerous pistils with lateral styles are observed, the rose itself being to all appearance the most anomalous of the tribe, owing the extension of the tube of the calyx and the contraction of its orifice enclosing and concealing the carpels, which in most of the others are exposed. The genera naturally divide themselves into four groups—1st. *Roseae*, distinguished as above by its tubular ventricose calyx enclosing the ovaries—2d. *Potentilleae*, by its numerous ovaries seated on an elevated fleshy receptacle—3d. *Spirææ*, by its definite ovaries (about 5) each with a terminal style and several ovules; follicular fruit, with two rows of suspended seed in each follicle; and lastly, *Quillaieae* like *Spirææ* but trees, having winged seed, with simple, not lobed leaves, (all American.)

GEOGRAPHICAL DISTRIBUTION. Principally natives of temperate or cold climates of the northern hemisphere. The species found within the tropics are natives of high hills, where the temperature is reduced by elevation. Such is the case with all those found in the Indian peninsula, figures of several of which will be found in the 12th number of my Icones.

PROPERTIES AND USES. No rosaceous plants are unwholesome and some of them furnish us with most delicate fruit. In the plant the astringent principle generally predominates and in the *Tormentilla* so intensely that its roots are even used for tanning leather, some of them are reckoned febrifuge and have been administered as substitutes for Peruvian bark; *Brayera* an Abyssinean plant is said to be one of the most powerful anthelmentics in the world, it being stated by Brayer its discoverer, that, two or three doses of its infusion are sufficient to cure the most obstinate cases of tapeworm. *Rosaceae* are however best known for the beauty and fragrance of the type of the family, the *Rose*, and for their fruit, of which the strawberry, raspberry, and blackberry, are the most esteemed. Some of the Indian species of *Rubus* even in their uncultivated state produce very passable fruit, which might be greatly improved by culture and certainly merit a trial. Judging from the great advances which within these few years have been made in the culture of the rose in this country, we have strong reason to hope for most ample success in this attempt. The strawberry is now cultivated to a considerable extent about Hyderabad and Bangalore and has even succeeded in producing fruit in Madras, but as yet our attempts at culture have not been crowned with much success.

Sub-order POMEAE. The Apple tribe.

" *Calyx* superior, 5-toothed; the odd segment posterior. *Petals* 5, unguiculate, inserted in the throat of the calyx; the odd one anterior. *Stamens* indefinite, inserted in a ring in the throat of the calyx. *Disk* thin, clothing the sides of the tube of the calyx. *Ovaries* from 1 to 5, adhering more or less to the sides of the calyx and each other; ovules usually 2, collateral, ascending, very rarely solitary; *Styles* from 1 to 5; *stigmas* simple. *Fruit* a pome, 1 to 5-celled, seldom spuriously 10-celled; the endocarp either cartilaginous, spongy, or bony. *Seeds* ascending, solitary. *Albumen* none; embryo erect, with flat *cotyledons*, or convolute ones in Chamameles, and a short conical *radicle*.—*Trees* or *shrubs*. *Leaves* alternate, stipulate, simple, or compound. *Flowers* in terminal cymes, white or pink."

Affinities. These differ from the preceding by the adhesion of the ovaries with the sides of the calyx and more or less with each other. " The fruit is always a pome; that is, it is made up of a fleshy calyx adhering to fleshy or bony ovaries, containing a definite number of seeds. *Pomeae* are principally distinguished by their ovules being in pairs and side by side, while *Rosaceae*, when they have two or more ascending ovules, always have them one above the other. Cultivated plants of this order are very apt to produce monstrous flowers which depart sometimes in a most remarkable degree from their normal state: nor can any order be more instructively studied with a view morphological inquiries, particularly the common pear when in blossom. A remarkable permanent monster of this kind with 14 styles, 14 ovaries and a calyx, with 10 divisions in two rows is described in the *Revue Encyclopedique*, thus exhibiting a tendency on the part of *Pomeae* to assume the indefinite ovaries and double calyx of *Rosaceae*. I have seen a *Prunus* in a similar state"—Lindley.

Geographical Distribution. Plants of this sub-order abound in Europe and northern Asia, a few are found in the mountains of India. Two species of *Photinea* are found in the Indian peninsula and Ceylon, and the *Loquat* (*Eryobotria*) is generally cultivated in India, and, besides yielding a fine fruit, is found very useful as a stock on which to graft the apple. The apple also thrives well and produces good fruit not only in the cooler parts of the Peninsula, but even in Madras, where several fine apples have been ripened.

Properties and Uses. The apple and pear are too generally known and esteemed to require more notice here than that of being named. In this country the *Loquat* is also pretty well known though scarcely so well as it deserves. The two species of *Photinea* are almost unknown but with the view of extending our knowledge of them I have figured both, one here, and the other in the Icones. Should they be found to thrive on the plains they may prove useful as stocks for grafting on, none of the other genera are known in this country.

Sub-order Amygdaleae. The Almond tribe.

" *Calyx* 5-toothed, deciduous, lined with a disk; the fifth lobe next the axis. *Petals* 5, perigynous. *Stamens* 20, or thereabouts, arising from the throat of the calyx, in æstivation curved inwards; *anthers* innate, 2-celled, bursting longitudinally. *Ovary* superior, solitary, simple, 1-celled; *ovules* 2, suspended; *styles* terminal, with a furrow on one side, terminating in a reniform *stigma*. *Fruit* a drupe, with the putamen sometimes separating spontaneously from the sarcocarp. *Seeds* mostly solitary, suspended, in consequence of the cohesion of a funiculus umbilicalis, arising from the base or the cavity of the ovary, with its side. *Embryo* straight, with the radicle pointing to the hilum; *cotyledons* thick; *albumen* none. *Trees* or *shrubs*. *Leaves* simple, alternate, usually glandular towards the base. *Stipules* simple, mostly glandular. *Flowers* white or pink. *Hydrocyanic acid* present in the leaves and kernel."

Affinities. To this sub-order all our stone fruit belong: the sloe and its numerous derivatives, the almost endless variety of plums: the cherry in all its various forms: and the almond from which, according to some, cultivation has elicited the various kinds of peaches, nectarines, and apricots, but which others consider distinct species. They are distinguished from the two preceding orders by the fruit being a drupe (a succulent stone fruit) by their bark yielding gum, but most remarkably by the presence of Prussic or Hydrocyanic acid. To *Leguminosae* they approach through *Detarium* which has a drupaceous fruit, but are separated by their regular petals and stamens, by the position of the odd sepal and by the presence of Prussic acid " It is not a little remarkable that here, where we have a close approach to the structure of *Mimoseae*, in *Leguminosae*, we have also the only instance among *Rosaceae* of an approach to the property possessed by that sub-order of the bark yielding gum; the peculiar astringency of some species is also analogous to that of *Acacia catechu* and the like." Lindley.

Geographical Distribution. None of the species of this sub-order are known to exist

in the southern portions of India, but a few are found on the Himalayas, and two species of *Polyodontia* in Ceylon, generally they are confined to the colder regions of the northern hemisphere. The peach has been introduced into India and in some places thrives well, producing fine fruit, but this is the only one of the tribe I have heard of yielding good fruit in this country. I have seen plum trees but have not seen the fruit. I do not recollect of ever having met with a cherry tree or a cherry in India.

Properties and Uses. To dwell on these here would be out of place since none of the species are to be had in this country, but it may be mentioned again that both the leaves and kernels of some of the species produce Prussic acid in such abundance as to become poisonous to cattle that brouse on them, and it may equally be mentioned that Prussic acid is the most immediately destructive of life of all vegetable poisons; a few seconds often sufficing for its total extinction when the acid has been sufficiently concentrated.

Notwithstanding this intense energy of action it has yet been beneficially employed in medicine for the treatment of some diseases, generally, of an obstinate or nearly incurable character. More recently it has been tried in a case of Hydrophobia in very large doses and seemed to have arrested the progress of the animal poison, as the patient completely recovered the powers of deglutition, but finally died of Typhoid symptoms, apparently induced through the exhaustion caused by the combined action of two such powerful poisons on the system. First by the deleterious effects of the animal one, which had never been overcome, until met by this more energetic vegetable one, and then by the enormous doses of the Prussic acid which were so powerful as at one time nearly to destroy life within a few minutes after administration. The case though it finally terminated fatally, yet holds out a hope of cure in that hitherto incurable malady Hydrophobia, since, it goes far to prove the efficiency of the one poison to overcome or counteract the deleterious effects of the other on the living animal fibre. To Prussic acid Noyeau owes its peculiar flavour, and that fact should make people cautious not to use much of a Liqueur, depending for its excellence on so active and dangerous an ingredient, so active indeed, that merely smelling the concentrated acid is enough to endanger or even to destroy life.

Sub-order Sanguisorbeae. The Burnet tribe.

" *Flowers* often unisexual. *Calyx* with a thickened tube and a 3-4 or 5-lobed limb, its tube lined with a disk. *Petals* none. *Stamens* definite, sometimes fewer than the segments of the calyx, with which they are then alternate, arising from the orifice of the calyx; *anthers* 2-celled, innate, bursting longitudinally, occasionally, 1-celled, bursting transversely. *Ovary* solitary, simple, with a style proceeding from the apex or the base; ovule *solitary*, always attached to that part of the ovary which is next the base of the style. *Stigma* compound or simple. *Nut* solitary, enclosed in the often indurated tube of the calyx. *Seed* solitary, suspended or ascending: *embryo* without albumen; *radicle* superior or inferior. Cotyledons large, plano-convex.—Herbaceous plants or *undershrubs*, occasionally spiny. *Leaves* simple and lobed, or compound, alternate, with stipules. *Flowers* small, often capitate."

This sub-order is one of very inferior note and may even be doubted whether it ought to remain here. *Alchemilla vulgaris* or lady's mantle is a native of the higher hills of India and Ceylon, but so far as I am aware none of the other genera are found in southern India This is the only tribe of *Rosaceae* found at the Cape of Good Hope. They are very common in Europe in open heaths and exposed situations. The celebrated Frederick Hoffman states that " a decoction of *Alchemilla vulgaris* has the effect of restoring the faded beauty of ladies to its earliest freshness."

I copy this piece of information as I am enabled to add that the plant in question is a native of the Neilgherries, and doubtless may be had there in sufficient quantity to admit of the experiment being tried, if we can only find fit subjects among our fair ones on whom to make the experiment.

Remarks on Genera and Species. In an order to which, so far as the Indian flora is concerned, so few of both belong, much space need not be devoted to this head. In the Penin-

POTENTILLA KLEINIANA (W&A.:)

sular flora, 6 genera are enumerated, only two of which are not found in Europe *Photinia* and *Eryobotria*, since the publication of our work one (*Alchemilla*) has been added to the continental flora and two to the Ceylon one, namely, *Agrimonia* and *Alchemilla*, and what is remarkable the species are identical with European ones. To these may be added, I believe, two of the sub-order *Amygdaleae* from Ceylon of which I have specimens, but the fruit too young to enable me with certainty to identify the genus, though, I think it may with considerable confidence be referred to Blume's genus *Polyodontia;* as, in addition to the similarity of the flowers, the leaves have the two glands on the under surface near the base. In Nepaul this order is comparatively abundant. From that country there several species of *Spiræa*, many of *Potentilla*, one or two of *Geum*, several of *Cerasus*, one or two of *Prunus*, one of *Pyrus* &c., and from the same tract of country Royle's *Prinsepia*, a genus which Messrs. Royle and Lindley refer to *Chrysobalaneæ*, but which, so far as I can make out from his not very perfect figure and character strictly belongs to *Amygdaleae*, and but for the baccate fruit might pass very well for a *Prunus*, whence I am disposed to infer that these two genera are very nearly allied, and that Lindley is premature in departing from the generally received opinion, that *Chrysobalaneæ* are but a section of *Rosaceae*. That *Prinsepia* does not belong to *Chrysobalaneæ* is shown by its style being terminal not arising from the base, and by its pendulous, not erect ovules. It differs from *Cerasus* and *Prunus* by having a baccate, not drupaceous fruit. Dr. Lindley proposes to remove the section *Sorbifoliae* from *Spiræa*, and form for them a distinct genus under the name of *Schizonotus*. His reasons for this separation are not stated by himself but Meisner assigns the following brief character. " Stamina disco calyce ubique adnato inserta, ovaria 5 connata stipitata. Cæt spirææ" one species only I have examined *Sp. (Schizonotus) Lindleana ?* and find that he (Meisner) has in that definition missed the only character of any value, namely, the position of the ovules. In *Spiræa* they are superposed, sometimes only two, sometimes several, but in *Schizonotus Lindleana* there are several 10 or 12 all pendulous from the apex of the cell of the ovary. This structure added to the very different habit seems to afford good grounds for the formation of a new genus. In it the ovaries are not stipitate.

POLYODONTIA, Blume.

Calyx inferior, campanulate, 6-toothed, deciduous: petals 6-minute, inserted on the margin of the calyx: stamens numerous, (12-18) about equal, inserted with the petals: ovary free, 1-celled, with 2 pendulous ovules: style one: stigma peltate: drupe reniform, dry, 1-seeded: embryo exalbuminous, inverse.

Leaves alternate, entire, exstipulate, usually furnished beneath, with two glands near the base: racemes axillary and lateral, solitary, or several together, tomentose, flowers small, 1 bracteated. (" *Genus hocci vix ali Amygdalo differre videtur*" Blume.)

P. arborea, (Bl.) Leaves alternate, oblong, entire, exstipulate, bi-glandular, beneath near the base: racemes axillary and lateral, solitary, or several; tomentose.—Blume, Bijdr. p. 1105.

Hab.—*Alpine forests in Java.*

P. ? Ceylanica, (R. W.) Leaves from elliptic very obtuse at both ends, to sub-orbicular, glabrous, when dry, of a rusty brown colour beneath, racemes axillary, solitary, (always ?) about the length of the leaves, covered with short appressed hairs: flowers small, petals 5 reflexed, externally very hairy round the margin.

Ceylon in forests above Numbady.

My specimens were taken from a tree by the roadside, near the highest point of the ascent towards Newera Ellia.

P. ? Walkirii, (R. W.) Leaves oblong ovate, sub-acuminated, glabrous above, and with the young branches tomentose beneath, afterwards becoming glabrous, racemes axillary, solitary, petals and rachis densely clothed, with short rusty coloured tomentum.

Ceylon.—Communicated by Colonel Walker.

This species seems nearly allied with the Java one, but differs in having the ramuli and leaves tomentose. It certainly appears distinct from the preceding, but as I have only a solitary specimen I am not enabled to give more perfect distinguishing characters.

EXPLANATION OF PLATE 85.

1. *Potentilla Kleinian*, a small flowering plant—*natural size.*
2. An expanded flower.
3. The same partially dissected.
4. Stamens.
5. The ovary cut vertically, showing the attachment of the carpels to the surface of the receptacle.
6. A detached carpel.
7. The same cut vertically.
8. Cut transversely.

9-10. Portions of a leaf magnified.

EXPLANATION OF PLATE 86.

1. *Photiana notoniana—natural size.*
2. An expanded flower, side view.
3. Front view.
4. The same dissected, showing the stamens and the ovary forcibly detached from the calyx tube.
5. Stamens.
6. The ovary cut vertically, showing its cohesion with the calyx.
7. Ovary cut transversely, 2-celled, and two ovules n each.
8. A fruit nearly mature cut transversely, two of the ovules aborted.
9. A seed—*natural size.*
10. Magnified.
11. Cut transversely.
12. Cut vertically.
13. Cotyledons and embryo detached.

LVIII.—SALICARIEÆ.

In most modern works on Botany this order occurs under the name of *Lythrariae,* owing, I presume, to the genus *Salicaria,* having been reduced to the older one *Lythrum.* We have however retained older name *Salicarieae* in our Prodromus, and I continue to adopt it from not seeing adequate grounds for changing an already established name of an order, because the genus on which it was originally founded is reduced.

As compared with the three preceding orders this, though abounding in species, is one of very secondary importance to mankind, consisting, as it does, for the greater part of low herbaceous plants, mere weeds, and inconsiderable shrubs, the latter, more remarkable for their gaudy flowers than for any value in an economical point of view that attaches to them. Of the herbaceous division the stems are for the most part 4-seeded, often with acute angles, the shrubby ones on the contrary have round branches, or if at first square, with obtuse angles. The leaves are opposite, sometimes verticelled, and occasionally, though rarely alternate, sessile, or tapering into a short petiol, stipules none. The flowers are bi-sexual, regular, axillary, or aggregated, or cymose, sometimes by the abortion of the floral leaves towards the extremities of the branches, apparently spicate or racemose. It is divided into two sub-orders *Lythrariae* and *Ceratophylliae.*

Sub-order Lythrariae. Juss.

Calyx tubular or campanulate, lobed, the lobes sometimes with intermediate accessory lobes or teeth: æstivation valvate. Petals alternate with the lobes of the calyx, usually very deciduous, sometimes wanting. Stamens inserted a little below the petals, equal in number to them, or 2-3-4-times as many, rarely fewer: anthers introrse, bi-locular, bursting longitudinally. Ovarium superior, 2-4-celled; ovules numerous: style usually filiform, rarely very short: stigma usually capitate. Placentæ in the axis. Capsule membranous, surrounded by, but not combined with the calyx; usually 1-celled by the obliteration of the dissepiments, bursting longitudinally or irregularly. Seeds numerous, small. Albumen none. Embryo straight: radicle next the hilum: cotyledons flat and foliaceous.

Affinities. This order seems nearly allied in many respects to *Onagrariae,* from which however it is separated by its free, not adherent ovary. This circumstance further entitles it to rank next *Rosaceae* in preference to those orders in which the calyx adheres to the ovary. I copy the following remarks from Lindley's Natural System, 2d edition, as exhibiting the best view of its affinities I have met with.

"In many respects this order resembles *Onagrariae,* from which the superior ovary and many ribbed calyx distinguish it; also *Melastomaceae,* from which the superior ovary the veining of the leaves, and the æstivation of the stamens divide it. With *Labiatae* it has often a resemblance in habit but this goes no further. *Malvaceae,* however, appear to be the plants to which *Lythraceae* most nearly approach, as is indicated by *Lagerstraemea* and *Hibiscus,* as well as by *Lythrum* itself and *Napæa* Their strictly perigynous stamens place them in a widely different affinity according to the French school. Their resemblance to *Celastraceae* is completely established by the genus *Adenaria.*"

PHOTINIA NOTONIANA (WALL. ?)

Geographical Distribution. This order has a wide range, Europe, Africa, Asia and America, have indigenous species, one only, however, and that the common European *Lythrum Salicaria* has been found in New Holland. In India they abound, no fewer than 24 being already enumerated as belonging to the Peninsular flora, exclusive of two species of *Ceratophyllum* which most Botanists now remove from this order. These are distributed under 8 genera, the most prominent of which, as regards the number of species, is certainly *Ammannia*, but by far the most conspicuous as regards the species themselves are *Lagerstraemea* and *Grislea*, while *Lawsonia* is more common and much admired on account the fragrance of its flowers.

Properties and Uses. These are with few exceptions unknown or unimportant. Some species are astringent. The flowers of *Grislea tomentosa* mixed with *Morinda* are used to dye red. The leaves of *Lawsonia alba* have the property of staining the skin and nails of a deep orange colour, and are constantly employed by the natives for that purpose. It is much cultivated as a fence perhaps as much on account of the fragrance of its flowers, as for its fitness in other respects for the purpose for which it is ostensibly employed.

The *Lagerstraemias* are all trees or shrubs and remarkable for the beauty of their flowers. *L. reginae* is the most conspicuous, but *L. parviflora* and *microcarpa* perhaps the most beautiful when in flower. The only species of *Ammannia*, deserving notice is *A. vesicatoria*, Roxb. the leaves of which are so acrid that when bruised and applied, like a cataplasm, to the skin they very quickly blister it. When bruised they exhale a strong muriatic odour which is the best mark by which to distinguish the plant, but unfortunately is only applicable to the recent state.

Remarks on Genera and Species. This sub-order divides itself into two sections, *Lythreae* and *Lagerstraemiae*. The former of these is widely distributed the latter are almost entirely tropical. Of the first division 7 genera are enumerated in the Peninsular flora: of these, *Rotala*, *Ammannia* and *Nesæa* are very imperfectly distinguished by the characters now assigned to them though they afford good ones. In the 11th and 12th number of my Icones under plate 217, will be found an attempt to remodel these genera. According to the plan there sketched the pentandrous species of *Ammannia* are united with *Rotala* on account of the uneven number of their petals, stamens, and cells of the ovary: *Ammannia*, is limited to those species of the present genus having 4 petals, 4 stamens, and a 2-celled ovary: those having 4 stamens, 4 petals, a 4-cleft calyx, without accessory teeth and a 4-celled ovary, form a new genus under the name of *Mirkooa:* while those having twice as many stamens as petals, with half the number of cells to the ovary comprising, I believe, the whole of DeCandolle's section *Dyplostemoneae* I propose to refer to *Nesæa*.

This last, the essential character of which is to have twice as many stamens as lobes to the calyx, and ought to have half the number of cells to the ovary that it has petals, presents an anomaly not easily explained. In *N. triflora* I found the centre flower with a 4-lobed calyx, and 4-celled ovary, while the lateral ones had a 6-lobed calyx and 3-celled ovary. Is the difference owing to the union of the parts of the flower causing a reduction of half their number? The objection to this view is found in *Ammannia octandra*, all the flowers of which have 4 petals, 8 stamens, and a 4-celled ovary. My solitary specimen of *Nesæa triflora* a figure of which will appear in the 13th number of Icones, does not enable me to follow out the investigation, I am therefore constrained to leave for future enquiry the merits of the genus as here constituted, and also whether the theory proposed be tenable. Generic characters taken from the bracteal appendages I consider of secondary value as all have them more or less distinctly, some species of *Ammannia*, perhaps, being exceptions. *Nesæa* certainly is not.

When I proposed the distribution here sketched I had not examined the whole order, and fear that I have committed an error with reference to *Mirkooa*. That it ought to be removed from *Ammannia* I do not entertain a doubt, but that it ought to form a distinct genus may be questioned I had not then carefully examined it, in comparison with the genus *Ameletia*, nor re-examined my genus *Nimmonia* (by mistake called *Nimmoia*), as I have since done aided by

excellent specimens communicated by Mr. Nimmo himself, and find it truly referable to this order. The result of this examination has led to the conclusion that, with a slight extension of the character, all three genera might be reduced to one. *Ameletia indica* is not apetalous, the petals are small resembling those of *Rhamneae*, but they are present and seem to have been mistaken for the tooth-like processes of most of the other genera of the order, but which in it can scarcely be said to exist; its character therefore ought to have been petals 4, minute, stamens 4, ovary 2-celled, capsule 2-valved, dehiscence septifragal. *Nimmonia* only differs in having larger petals in both they are marcescent. *Mirkooa* however differs from both in having a 4-celled ovary and a 4-valved capsule, but the dehiscence is septifragal as in the other and the petals are equally marcescent, hence the only difference rests in the ovary and capsule, which might be easily adjusted in the generic character. Having premised these explanations I now substitute for the classification in the Icones the following series.

1.	Calyx 3-5 cleft. Petals 3-5. Stamens 3-5. Ovary 3-celled. Capsule 3-valved, septifragal	ROTALA. *Ammannia*, partly.
2.	Calyx 5-cleft, the sinuses furnished with accessory teeth, petals 4 or 0 ? (by abortion) Stamens 4, ovary 2-celled: capsule opening irregularly transversely, (the upper part falling away)	AMMANNIA.
3.	Calyx 4-cleft, without accessory teeth, petals 4, stamens 4, ovary 2 or 4-celled. Capsule 2 or 4-valved, septifragal, (flowers in bracteated spikes, calyx bi-bractiolate)	AMELETIA. *Mirkooa*, W. and A. *Nimmonia*, R. W.
4.	Calyx 4-6-cleft, with accessory teeth in the sinuses, petals 4-6, stamens 8-12, ovary 3-4-celled	NESÆA. *Ammannia*, partly.

None of the other genera of the order require notice. To *Lagerstraemia* I have added one new species *L. microcarpa* (Icones Pl. In. Or. tab. 109) which we had formerly confounded with Roxburgh's *L. parviflora*. Icon. tab. 69. The latter species has a large fruit while that of my new species scarcely exceeds the size of a pea.

The sub-order *Ceratophylliae* differs so widely in habit and approaches so little in structure, that I cannot help following the footsteps of most modern Botanists in excluding it from this place.

ROTALA, Linn. (W. and A.)

R. verticellarus, (Linn.) calyx 3-5, lobed, petals and stamens 3-5: leaves verticelled. Icon. Pl. Ind. Or. tab. 260.

R. Roxburgiana, (R. W.) calyx 5-lobed, petals and stamens 5, leaves opposite.—Wight—Icon. Pl. Ind. Or. tab. 260.—*Ammannia pentandra*, Roxb. D.C. Prod. W. and A. Prod.

R. fimbriata, (R. W.) calyx 5-lobed, petals and stamens 5: petals fimbriated on the margin, leaves opposite—Icon. Pl. Ind. Or. tab. 217.

AMELETIA, D.C.

§ Ovary 2-celled. Capsule 2-valved.

A. Leaves opposite.

1. *A. indica*—2. *A. tenuis*.

B. Leaves alternate.

3. *A. floribunda*.

§ Ovary 4-celled. Capsule 4-valved.

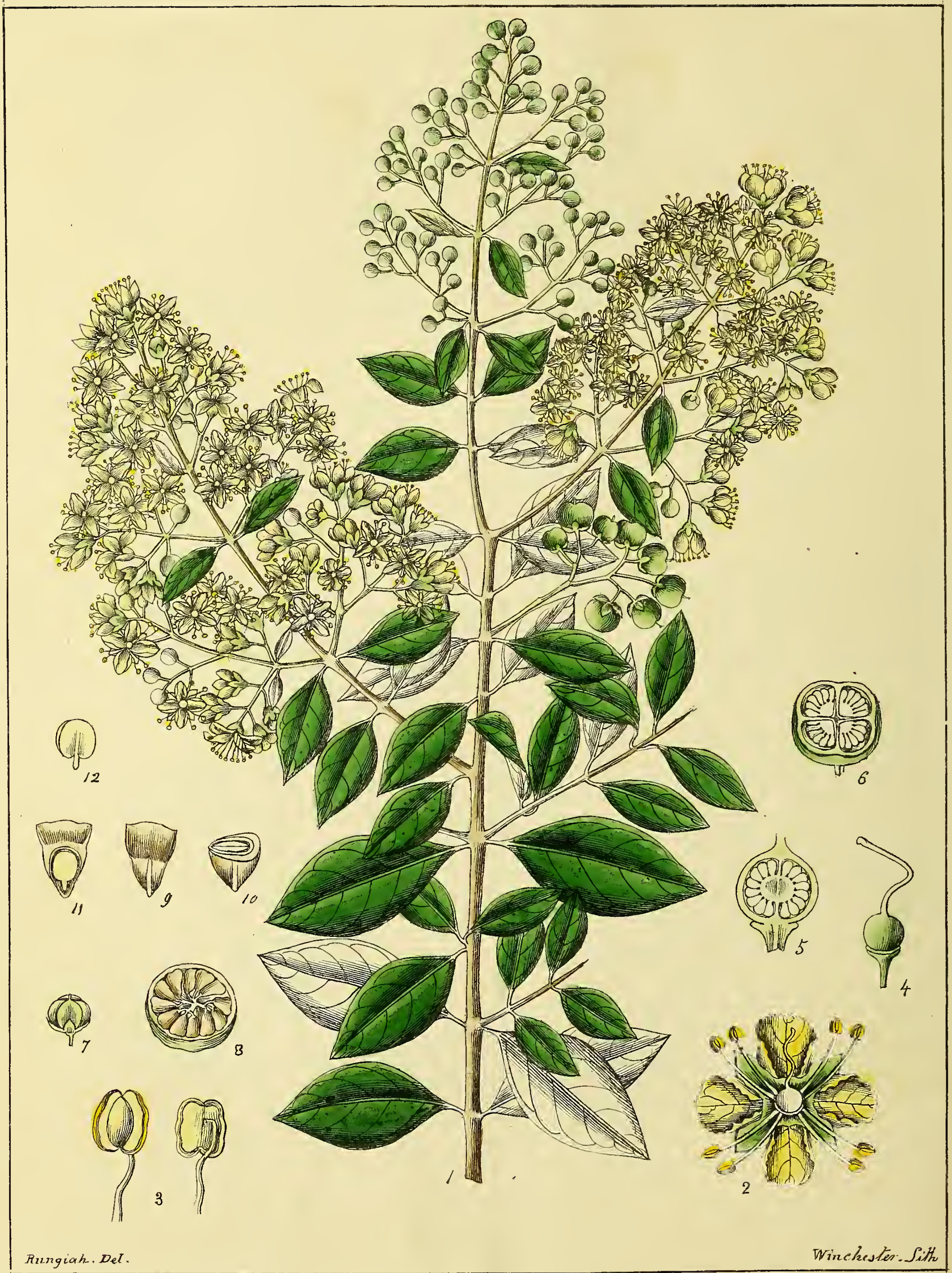
4. *A. rotundifolia*.

1. *A. indica*, (D.C.) Procumbent, leaves obovate, opposite, spikes axillary: flowers sessile, solitary, in the axils of obovate bracteæ; bracteoles subulate, membranaceous, equalling the tube of the calyx. Stamens shorter than the calyx.

2. *A. tenuis*, (R. W.) Shrubs somewhat procumbent at the base, afterwards erect, most slender leaves opposite, orbicular, spikes terminal, flowers solitary, longish, pedicelled, from the axil of a linear bractea; bracteoles large: stamens included; style projecting: stigma large: capsule 2-valved—Icon. Pl. Ind. Or. tab. 258.

3. *A. floribunda*, (R. W.) Erect, very ramous, leaves alternate, sessile, cordate at the base, linear, lanceolate: spikes terminal, few-flowered: flowers short, pedicelled, solitary, in the axils of linear lanceolate, bracteas: bracteoles about half the length of the calyx: petals obovate: stamens short, included within the tube of the calyx: style long, projecting, capsule ovate, 2-valved.—Icon. Pl Ind. Or. tab. 258. *Nimmonia floribunda*, R. W. in. Madras Journal of Science.

4. *A. rotundifolia*, (R. W.) Stems diffuse, procumbent, branches erect: leaves orbicular, opposite, sessile: spikes congested near the extremities of the branches, flowers solitary, in the axils of the sessile, sub-orbicular or broad ovate, cordate, pointed bracteas; bracteoles very minute, almost inconspicuous: stamens much longer than the calyx, capsule 4-valved—Icon. Pl. Ind. Or. tab. 259.



மரதனவண.
அயவிணணனி.
Murthennay.
Ivenny.

LAWSONIA ALBA. (Lam.:)

గోరంఢ్ట.
Goruntah.

LAGERSTRŒMIA INDICA. (LINN.)

EXPLANATION OF PLATE 87.

1. *Lawsonia alba—natural size.*
2. An expanded flower seen from above.
3. Stamens back and front views.
4. The ovary.
5-6. Cut transversely and vertically.
7. The fruit nearly mature—*natural size.*
8. The same cut transversely.
9. A seed somewhat winged.
10. The same cut transversely.
11. Cut vertically, showing the embryo *in situ.*
12. Embryo detached—*with the exceptions mentioned, all more or less magnified.*

EXPLANATION OF PLATE 88.

1. *Lagerstrœmia indica,* flowering branch—*natural size.*
2. A dissected flower.
3-4. Anthers back and front views.
5. Stigma.
6-7. Ovary cut vertically and transversely, 6-celled, with the ovules collateral.
8. A fruit not quite mature.
9-10. Horizontal and vertical sections of the same.
11. A seed—*natural size.*
12-13. The same magnified and opened, to show the position of the seed.
14. A detached seed.
15. The embryo removed from the testa, cotyledons foliaceous, convolute—*with the exceptions mentioned, all more or less magnified.*

LIX.—RHIZOPHOREÆ.

This is a small, but widely diffused order, growing on salt swamps and marshes on the sea coasts of nearly all tropical countries, constituting the mangrove tribe, so noted for the unwholesome climate which often prevails where it is very abundant, apparently, through the dense mass of vegetation which it produces intercepting the sun's rays, and maintaining a constant exhalation of noxious vapour from about their roots. Like the Banyan (*Ficus indica*) and the Caldera, (*Pandanus odoratissimus*) most of the species send down roots from the stem and branches, by means of which they rapidly spread themselves to a great extent. Another very remarkable peculiarity of this family is the unique manner in which its seed germinates; here germination takes place not as in other plants after the shedding of the seed, but before it has left the seed vessel. After the seed has attained maturity its radicle and club-shaped tigillus gradually elongates until it either enters the soft muddy soil in which the tree grows, or if more elevated it drops and fixing itself in the muddy bottom immediately strikes root at the one end while the leaves begin to develope themselves at the other. The species are all trees or shrubs with opposite coriaceous simple entire leaves, sometimes, in *Carallia,* dentate, usually tapering towards the petiol and furnished with interpetiolar convolute caducous stipules. The flowers are bi-sexual, regular, axillary, congregated in few or many-flowered cymes. Dr. Arnott in an excellent memoir on the order published in the Annals of Natural History, vol. 1st, has given a detailed character of the Linnæan genus *Rhizophora,* but which he thinks ought rather to be considered a group or sub-order, of *Rhizophoreae,* as containing several distinct genera. The group may be called *Rhizophorae,* he defines it as follows.

" Calyx 4-14 cleft, persisting: æstivation valvate. Petals sessile, 4-14, inserted into the calyx and alternate with its lobes. Stamens 8 or more, inserted with the petals: filaments distinct, anthers 2-celled, dehiscing within. Disk fleshy between the ovary and calyx, occasionally forming a short toothed ring between the stamens and ovary. Ovary more or less cohering, 2-4-celled, cells 2-ovuled, ovules pendulous from the apex of a central axis. Style simple. Stigma 2-4, dentate or simple. Fruit coriaceous, 1-celled, 1-seeded, after germination has commenced perforated at the apex, by the extension of the radicle and tigillus of the embryo into a long club. Albumen none. Cotyledons flat, radicle superior."

This character does not include *Carallia,* the seed of which do not germinate in the perecarp, but with that exception, the character applies to it also.

Affinities. This order differs from all others in the remarkable property of its seed germinating before they have left the tree. The structure and dehiscence of the anther in *Rhizophora* is also very peculiar. In place of as usual consisting of two parallel cells opening either by pores at the apex or by slits, it seems to consist of a solid central axis, the surface of which contains numerous fovioli containing the pollen and covered by a membrane, when mature

this membrane bursts interiorly or towards the centre of the flower and sheds the pollen, after which the membranous valve withers and almost disappears, leaving the fleshy body of the anther in its place apparently as large or even larger than when the flower first expanded. I first had an opportunity of observing the anther of *R. mucronata* about 10 years ago, and endeavoured to represent it before and after dehiscence. The attempt was not very successful but such as it was I have recently published it tab. 238 of my Icones. Since then (in 1835 ?) Mr. Griffith published a paper on the *Rhyzophoreae* in the transactions of the Medical and Physical Society of Calcutta, accompanied with delineations of the anther of this genus, accompanied by some ingenious remarks on its formation. This structure, which is confined to the species of this genus, he very properly considers of itself a sufficient reason for separating them as a genus from the rest of the order even supposing there was no other, which however is not the case, hence this cannot but be considered a good genus. Passing over these peculiarities, which do not extend to all the species of the order, its nearest allies seem to be, *Memecyleae*, *Lethrarieae* and *Myrtaceae*, and though the relationship does not appear to be very close, we yet find the same plant in one or two instances referred to different orders, thus we find, according to Arnott, that, *Petalosoma* of D.C. doubtfully referred by him to *Myrtaceae*, is not distinct from *Carallia:* and *Olisbia* D.C. placed without a doubt in *Rhyzophoreae,* referred by Lindley and Arnott under the name *Guildingia* to *Memecyleae.*

Geographical Distribution. I mentioned above that plants of this order occupy a wide range, inhabiting salt marshes, especially near the mouths of great rivers, in tropical countries. The following rather long extract from Dr. Arnott's paper gives a more precise account of their distribution which is my reason for introducing it here.

" Martius in his observations on India plants in the '*Algemeine Zeitung*' for January 1834, and '*Ann. des Sc. Nat.*' n. s. i. p. 250, mentions that there are eleven species of *Rhizophoreae* in East India according to Wallich's list: there are however only eight noticed by Dr. Wallich, but this number may be made up of the three species of *Carallia* described in DeCandolle's Prodromus, of *Rhizophora conjugata, gymnorrhiza* and *cylindrica* of Linnæus; *R. caryophylloides,* Jack; *R. candel* and *candelaria* of DeCandolle, with *R. parviflora* and *decandra* of Roxburgh, mentioned in Wallich's list. While one of these has been unnecessarily spilt down, others, very distinct, appear to be confused under the same names, and Blume's are altogether omitted. I have now enumerated fifteen species of *Rhizophoreae verae* from which we must deduct one from America and another from New Holland not found in East India. Of the remaining thirteen, one from Cochin China is scarcely known; a second extends throughout the Indian ocean, from the Mauritius to the Moluccas or perhaps Timor, and as far north as Arabia Felix and Bengal; a third is found in Malabar, Timor, and New Holland; three appear to be confined to the Eastern Islands; two to Malabar; one is common to Malabar and the mouth of the Ganges; two found at the mouth of the Ganges occur probably also further east and in Penang, and the remaining two seem to have been observed (unless different species are alluded to by different authors) in Ceylon, Malabar, Bengal, Java, and Amboyna. To these thirteen have to be added, Roxburgh's two species of *Carallia* with serrated, and the four species or varieties I have mentioned with entire leaves: so that although Loureiro's *Rhiz. hexagona* were reduced, the number is about double of that given by Martius. This order is thus concentrated in India or its Islands; the only known exceptions consist in the two or perhaps three species of *Rhizophora* and one *Carallia* that occur further west, and one *Ceriops* and one *Bruguieria* that are found in New Holland; but of these, two are also natives of India."

Properties and Uses. On this head no very precise information exists, the bark of several species is astringent and has been used as a febrifuge. In the Antilles the fruit of *Rizoph: mangle* is said to be sweet and edible and the juice is fermented to form a light wine. When growing within low water mark the lower branches and stems are sometimes covered with oysters which are esteemed, by those who have an opportunity of procuring them, a great delicacy. The wood of *R. mucronata* is said by Roxburgh to be of a dark redish colour, hard and durable while that of *Bruguieria Rheedei* is described as being of a yellowish colour, hard and durable, but is chiefly employed for burning and for posts with which the natives construct their houses.

Remarks on Genera and Species. The most perfect account by far, yet published of this order is that by Dr. Arnott in the "*Annals of Natural History*" vol. 1. page 359-374 inclusive. To this paper I must refer those desirous of becoming intimately acquainted with it, but will here embody some portion of the information it contains. Of *Rhizophoreae verae* he has 4 genera, one of these (*Ceriops*) new; and defines 15 species, one imperfectly known, which are thus distributed—*Rhizophora* 3, *Ceriops* 2, *Kandelia* 1, and *Bruguieria* 8—and one scarcely known, of these 9 are certainly Indian species. As I have reason to believe the Journal in which these are published is but little known in India, I shall introduce here the original generic and specific characters of the author with his synonyms, excluding however the remarks on each, which would occupy more space than can be devoted to the subject in these pages, adding to each Mr. Griffith's synonyms derived from his paper in the Calcutta Medical transactions.

RHIZOPHORA, *Lam. Kunth. Blume*, W. and A.

Calyx 4-fidus; laciniæ tubo 2-3-plo longiores. *Petala* 4 lanceolata acuminata apice nuda. *Stamina* 8-11, quorum 4 petalis opposita: filamenta brevissima; antheræ magnæ, sub-sessiles, basi affixæ conniventus, oblongo-lineares, acuminatæ, breviter cuspidatæ. *Ovarium* semi-adhærens, biloculare, 4-ovulatum, parte libera ovata carnosa solida, sensim in *stylum* conicum brevem acuminata. *Fructus* sub-ovatus, basi calycis laciniis recurvis coronatus, tubo longior.

Pedunculi 2-3-*fidi vel dichotimi;* calyx *bractea cupulata suffultus.* Flores *magni:* alabastra *ovoidea lævia.*

§ 1. Stamina 8. Petala concava, coriacea, stamen unicum antepositum foventia, versus margines induplicatos villosa. Pedunculi ex axillis foliorum hornotinorum orti, petiolis sub-longiores, 2-3-fidi dichotomi: flores plus minusvi pedicellati.

1. *R. Mangle*, (Linn.); foliis obovato-oblongis, obtusis. —æ, pedunculis 2-3 floris; floribus sublonge pedicellatis, calycis laciniis triangulari-oblongis.—R. Mangle, *Linn. Sp.* p. 634 (ex parte); *D.C. Prod.* 3 p. 32; *Velloz. Fl. Flum. v. t.* 1.—*β* ? pedunculis dichotomis.—R. racemosa, *Meyer prim. Essq.* p. 185 *D.C. l. c.*—*Hab.* in America, et ? Africæ oris occidentalibus.

2. R. mucronata, *Lam.;* foliis ovalibus longe cuspidatis, calycis lacyniis triangulari ovatis.—R. mucronata, *Lam. Enc.* Meth. 6 p. 16? ; *ill. tab.* 396 *fig.* 2. *D.C. l. c.; Decaisne in Ann. Sc. Nat. n. s.* 4 p. 75.—R. Mangle, *Linn.* ? (ex parte). *Roxb. Fl. Ind.* 2 p. 459. *Blum. en Pl. Jav.* 1 p. 91 (excl. syn).—R. candilaria, *Wall. cat. n.* 4878. *Wight, et Arn. Prod. Fl. Penins.* I. O. 1 p. 310, (non D.C.) *Wight, cat. n.* 1041. R. macrorhiza, *Griffith. Hab.* in insulis Mauritio, Madagascar, Ceylano, et Java, in Arabia Felice prope Yemen (Bove n. 230) Malab ad aria, ostia Gangis, ac verosimiliter in aliis multis Indiæ orientalis maritimis.

§ 2. Stamina nunc 8, sæpius 11-12. Petala plana, sub-membranacea, glaberrima. Pedunculi petiolo multo breviores, ex axillis foliorum annotinorum orti, crassi, apice sub-biflori: flores sessiles.

3. *R. conjugata*, (Linn.); foliis oblongis sub-acuminatis longe cuspidatis. *Linn. Sp.* p. 634; *Fl. Ceyl. n.* 181. *D.C. l. c.* p. 33; *Wight, cat. n.* 2449. *Roxb. Hort. Beng.* p. 36 (in Fl. Indica omissa).—R. Candelaria, *D.C. l.c. Griffith, l. c.*—R. apiculata, *Blum. en Pl. Jav.* 1 p. 91.—*Rheed. H. Mal.* vi. *tab.* 34. *Rump Amb.* iii. t. 71 et 72.

Hab. in insulis Ceylano et Java, in Malabarica prope Cochin, &c. *Rheede*, Quilon; *Wight.*

2 CERIOPS, Arn.

Calyx 5-fidus; laciniæ tubo 2 3-plo longiores. *Petala* 5, ovalia, emarginata, apice setigera, plana, ante anthesin stamina duo amplectentia. *Stamina* 10, erecta; filamenta petalis sub-dimidio breviora: antheræ cordato-ovatæ, obtusæ, filamentis multo breviores, dorso paullo supra basin affixæ. *Ovarium* semiadhærens, tri-(in una specie, forsan in omnibus) loculare, 6-ovulatum, parte libera ovata carnosa solida apice in *stylum* stamina superantem desinente. *Stigma* simpliciusculum. *Fructus* sub-ovatus, prope basin laciniis calycinis patenti-recurvis coronatus, tubo longior.

Pedunculi *petiolum sub-æquantes, cymum densiflorum sub-capitatum ferentes.* Calyx *bractea cupulata suffultus.* Flores *parvi, vix pisi magnitudine:* alabastra *sub-ovoidea.* Valde *a Rhizophora* differt hocce genus habitu, inflorescentia, floribus pentameris, petalis, staminibus, stigmate, et (an semper ?) ovario.

1. *C. Candolliana*, (Arn.); foliis obovalibus vel obovatis obtusissimis petalis margine glabris apice trisetis, setis clavatis. *Wight, Cat. n.* 2450.—Rhizophora Timoriensis, *D.C.* ? *Prod.* 3 p. 32; *Decaisne ? Herb. Timor.* p. 124.—Bruguieria Arnottiana, *Wight, in Litt.*

Hab. in oris Malabaricus prope Quilon; *Wight*, 1836. In insula Timor (fide *De Cand. et Decaisn*). "Careening bay" in Nova Hollandia; *Cunningham* (*in Herb. Hook.*)

2. *C. Roxburghiana*, (Arn.) foliis obovalibus obovatise obtusissimis petalis inferne glabris versus apicem setosa-ciliatis, setis (sub 7) validis.—Rhizophora decandra, *Roxb. Hort. Beng.* p. 36; in. cæt. *Merc. Ind. Mus. tab.* 1140 (in. Flor. Ind. omissa), *Wall. Cat. n.* 4875; *Herb. Ham. n.* 1109.—Bruguiera decandra, *Griffith, l. c.*

Hab. Ad ostia Gangis; *Goodlad; Hamilton.* Penang, Martaban, Tavoy &c. (fide *Wallich*).

3 KANDELIA, W. and A.

Calyx 5-fidus; laciniæ tubo 3-4-plo longiores, lineares, patentes. *Petala* 5, membranacea, glabra, basi linearia sub-canaliculata, ultra medium bifida, laciniis in fila plurima capillaria longa inæqualiter fissis. *Stamina* petalorum numero 6-8-pla: filamenta subulato-capillaria, calycis lacinias fere æquantia: antheræ oblongæ, parvæ, obtusæ, dorso paullo supra basin affixæ. *Ovarium* adhærens, 1-loculare, 6-ovulatum. *Stylus* filiformis, stamina sub-superans. *Stigma* 3-dentatum. *Fructus* oblongus, basi laciniis calycinis patentibus coronatus, tubo multo longior.

Arbor *parva.* Folia *anguste elliptico-oblonga, obtusa.* Pedunculi *petiolo longiores*, 2-3-*chotomi*, 4-9-*flori.* Flores *majusculi, nunc rarius* 6-*meri:* alabastra *prismatica.* Calyx *bractea cupulata suffultus. Embryonis germinantis* tigellus *clavato-subulatus, acutissimus.*

1. *K. Rheedie*, W. and A., *l. c.; Wight, Cat. n.* 1042 *Griffith* Rhizophora Candel. *Linn. sp. p.* 634 *D.C. l. c Wall. Cat. n.* 4876. *Roxb. Hort. Beng. p.* 36 (in Fl. Indica omissa); *Herb. Ham. n.* 1110.

Hab. ad oras Malabaricus præsertim australiores. *Rheede, Klein, Wight.* Ad ostia Gangis, *Hamilton.*

4. BRUGUIERIA, L'Her, Lam., Blume, W. and A.

Calyx 8-14-fidus: laciniæ tubum turbinatum sub-æquantes. *Petala* oblonga, bifida, basi circa stamina

duoanteposita arcte conduplicata vel convoluta. *Stamina* petalorum numero dupla, biserialia, e petalis tandem elastice dissilientia: filamenta petalis sub-dimidio breviora, inæqualia interioribus brevioribus: antheræ lineares vel oblongæ, acutæ, basi affixæ. *Ovarium* adhærens, 2-3-4-loculare, loculis 2 ovulatis. *Stylus* filiformis, staminum longitudine: stigma 2 3-4 dentatum. *Fructus* turbinatus, tubum calycis haud superans ac ejus laciniis apice coronatus.

Pedunculi 1-3 *vel pluriflori.* Calyx *basi nudus:* alabastra *fusiformia vel ovoidea.*

1. *B. gymnorrhiza*, (Blume) " foliis ovalibus acutis, petalorum laciniis apice nudis, fructibus" (seu tigellis) " cylindraceo-acutiusculis costatis" *Blume en Pl. Jav.* 1 p. 92 (non Lam., nisi quod ad fructum a Gærtnero mutuatum).—Rhizophora gymnorrhiza, *Linn. sp.* p. 634 (ex parte). *Gærtn. fr.* t. 45.—Mangium celsum, *Rumph. Amb.* 3 *p.* 102 t. 68.

Hab in Java atque Moluccis.

2. *B. cylindrica*, (Blume), " foliis oblongis acuminatis, petalorum laciniis apice nudis, fructibus" (seu tigellis) " cylindraceis obtusis lævibus." *Blume l. c.* p. 91 (excl. syn. Rheede.)—Rhizophora cylindrica, *Linn. sp. p.* 635 (ex parte).—Mangium digitatum, *Rumph. Amb.* iii. tab. 70.

Hab. in Moluccis et Java &c.

§ 2. *Petala apice setigera.*

Calycis laciniæ 9-14, lineari-acuminatæ, apicem versus triquetræ, fructiferæ sub-erectæ. Antheræ lineares. Ovarium 3 (nunc 4-) loculare. Pedunculi uniflori, cernui, folio breviores. Flores magni.

3. *B. Rheedei*, (Blume ?) foliis ovali-oblongis utrinque acuminatis, calyce 10-14-(sæpius 12-) fido laciniis demum erectis vel sub-incurvis, petails ima basi villosulis alioquin glaberrimis laciniis acutis apice bisetis cum seta quinta in fissura. *Blume ? l. c. p.* 92.—B. gymrorrhiza, *Lam.* (quoad *flores*) *ill. t.* 397. *f. a. b. c.* et forsan *d-f. Herb. Ham. n.* 1111. *Wight et Arn. l. c. p.* 311 (ex parte); *Wight, Cat. n.* 1043 (ex parte).—Rhizophora gymnorrhiza, *Linn. sp. p* 634. (ex parte) *Roxb. Fl. Ind.* ii. *p* 460; *in cœt. Merc. I. O. Mus. tab.* 1246. *Wall. Cat. n.* 4874. *Lour. ? Coch* (*ed Willd.*) *p.* 364.—*Rheed. H. Mal.* vi. t. 31 et 32. *Rumph. Amb.* t. 69. (fide Blume; itaque huc trahenda *R. Palun, D.C. l. c.*)

Hab. in Malabaria *Rheede, Wight.* Ad ostia Gangis. *Goodlab, Hamilton.* In Moluccis as Java (fide *Blumei*) Cochin-china, *Loureiro.* In Penang, &c. Wallich.

Tigellus sub-cylindricus, lævis, utrinque acuminatus, in hac, et forsan in aliis hujus sub-sectionis speciebus.

4. *B. Australis*, (Cunn.): foliis ovali-oblongis utrinque acuminatis, calyce 9-10-fido, petalis basi lanatis secus margines pilosis laciniis linearibus obtusiusculis versus apicem sub-4-setis cum nona longiuscula in fissura.

Hab. ad " Moreton bay" Novæ Hollandiæ, *A. Cunningham*, (in Herb. Hook.)

5. *B. eriopetala*, (W. & A.); foliis ovali-oblongis utrinque acuminatis, calyce sub 10-fido, petalis a basi ad apicem versus margines dense argenteo-hirsutis laciniis obtusiusculis prope apicem unisetis cum seta tertia longiuscula in fissura. *Wight. Cat. n.* 2451.—B. gymnorrhiza, *W. et A. l. c.* (ex parte); *Wight. Cat. n.* 1043 (ex parte).—Griffith l. c.

Hab. ad Quilon, *Wight.*

Calycis laciniæ 8, oblongo-lineares, planiusculæ, fructiferæ patentes. Petala and margines parce villosula, laciniis apice 3-4 setis cum seta unica in fissura. Antheræ lineari-oblongæ. Ovarium 2-3-loculare. Pedunculi pluri flori. Tigellus germinans sub-cylindricus, læviusculus.

6. *B. caryophylloides*, (Blume) foliis ovalibus utrinque acutis, pedunculis petiolo brevioribus 3-(nunc dichotome 5-) floris, calycis laciniis acutis, ovario biloculare, tigello subclavato acutiusculo. *Blume, l. c. p.* 93.—Rhizophora caryophylloides, *Burm. Ind. p.* 109. *Jack, in Mal. misci. p.* 34; *in Hook. Bot. Misc.* ii. *p.* 80; *Wall. Cat. n.* 4879.—*Rumph. Amb.* iii. *tab.* 78. B. cylindrica, *Griffith, l. c.*

Hab. in Singapore et Pulo-Penang, *Jack.* Circa Bataviam, *Blume.* In Moluccis *Rumph.*

7. *B. malabarica*, (Arn.); foliis elliptico-oblongis utrinque acuminatis, pedunculis petiolum æquantibus apice trifloris, floribus arcte sessilibus calycis laciniis obtusiusculis, ovario biloculari; tigello cylindrico demum supra medium paullo attenuato obtuso. *Wight. Cat. n.* 2452.—Rhizophora cylindrica. *Linn. sp. p.* 635. (ex parte) *Rhecd. Mal.* vi. t. 33.

Hab. ad oras Malabariæ, *Rheede, Wight.*

8 *B. parviflora*, (Arn.); foliis elliptico-oblongis seu lato-lanceolatis, pedunculis semel bisve trichotomis multifloris, ovario 3 loculari, tigello sub-cylindrico, *Roxb. Griffith, l. c.*—Rhizophora parviflora, *Roxb. Fl. Ind.* ii. *p.* 461. R. cylindrica, *Roxb. Hort. Beng. p.* 36. *Wall. Cat. n.* 4877.

Hab. Ad ostia Gangis.

§. *Vix nota.*

9. *B. sexangula*, (Spr); foliis ovato-lanceolatis, pedunculis unifloris, calyce 10 fido magno laciniis acutis patentibus; petalis ciliatis, tigello prismatico æqualiter hexagono obtuso —Rhizophora sexangula, *Lour. Coch.* (*ed Willd.*) *p.* 363.

Hab. in Cochin china. *Loureiro.*

The following is a *Clavis Analytica* of the better known species. Fructus semiadhærens.

Petala 4..........................I. *Rhizophora*, L.
Petala 5.
  Stamina 10..................II. *Ceriops*, Arn.
  Stamina indefinita..........III. *Kandelia*, W. & A.
Fructus omnino adhærens....IV. *Bruguiera*, L. Her.

I. Petala margine villosa.
  Folia obtusa.... .... *R. Mangle*, L.
  Folia apiculata............... *R. mucronata*, Lam.
  Petala glaberrima........... *R. conjugata*, L.
II. Petala apice triseta......... *C. Candolliana*, Arn.
  Petala versus apicem setosa-ciliata................ } *C. Roxburghii*, Arn.
III. (Unica species)............ *K. Rheedei*, W. & A.
IV. Petala apice nuda.
  Tigelli costati.............. *B. gymnorrhiza*, Bl.
  Tigelli læves................ *B. cylindrica*, Bl.
Petala apice setigera.
Calycis laciniæ 9-14, fructiferæ erectiusculæ.
  Petala (salva basi) glaberrima.......................} *B. Rheedei*, Bl.
  Petala basi lanata secus margines pilosa...........} *B. Australis*, Cunn.
  Petala secus margines sericeo-hirsutissima........} *B. eriopetala*, W. & A.
Calycis laciniæ 8, fructiferæ patentes.
  Pedunculi sub-3 flori; ovarium 2 loculare.
  Folia utrinque acuta; pedunculi petiolo breviores..........................} *B. caryophylloides*, Bl.
  Folia utrinque acuminata; pedunculi pet. æquantes..........................} *B. malabarica*, Arn.
  Pedunculi multiflori; ovarium 3-loculare...........} *B. parviflora*, Arn.

Rungiah. del.
Winchester. Lith.

KANDELIA RHEEDEI (W. & A.)

CARALLIA CEYLANICA βARN.

CARALLIA.

1. *C. Ceylanica*, (Arn.); foliis cuneato-obovatis obtusissimis subretusis latitudine subdimidio-longioribus. *Arn. l. c.*; *Wight Cat. n.* 2446—C. obcordata, *Wight in litt.*
2. *C. corymbosa*, (Wight); foliis oblongo-obovalibus obtusis vel obsoleto ac obtuse acuminatis latitudine 2—2½ plo longioribus.—*Wight Cat. n.* 2447.—*Rheed. H. Mal.* v. *t.* 13 (inflorescentia ac floribus pessime delineatis.)
3. *C. Sinensis*, (Arn.); foliis cuneato-obovatis breviter ac obtuse acuminatis latitudine subduplo longioribus. *Arn. l. c.* (cum. syn.)
4. *C. integerrima*, (D.C.); foliis ovalibus subacuminatis latitudine duplo longioribus.

EXPLANATION OF PLATE 89.

1. *Kandelia Rheedei*, (W. & A.) Flowering branch—*natural size.*
2. A dissected flower to show the relative position of parts.
3. Stamens.
4. Stigma.
5-6. Ovary cut transversely and vertically, 3 celled, with two pendulous ovules in each.
7. A fruit at the commencement of germination.
8. A fruit after germination has considerably advanced nearly a foot in length—*natural size.*
9-10. Sections of the fruit and tigellus—*natural size, with the exceptions mentioned, all more or less magnified.*

EXPLANATION OF PLATE 90.

1. Flowering branch of *Carallia Ceylanicus*—*natural size.*
2. A dissected flower.
3. Stamens.
4. A petal detached.
5-6. Ovary cut transversely and vertically—*all more or less magnified.*

LX.—COMBRETACEÆ.

This is one of the most strictly tropical orders we have yet had to examine, for, though some species extend beyond these limits yet none go beyond the warmer latitudes on either side.

The species are all either trees or shrubs, often scandent, sometimes with opposite, sometimes alternate, coriaceous, simple, undivided, exstipulate leaves, rarely with pellucid dots. The flowers are regular, generally bi-sexual, but sometimes by abortion, unisexual, or polygamous, arranged in axillary or terminal spikes or capitulæ.

" Calyx 4-5 lobed, lobes deciduous. Petals alternate with the lobes, or wanting. Stamens twice as many as the lobes, rarely, equal in number to them or thrice as many: filaments distinct, subulate: anthers bi-locular, bursting longitudinally. Ovarium coherent with the tube of the calyx, 1-celled: ovules 2-5, pendulous from the apex of the cavity: style 1, slender: stigma simple. Fruit drupaceous, baccate, or nutlike, 1-celled, indehiscent, often winged. Seed solitary (by abortion) pendulous. Albumen none. Radicle superior: cotyledons usually leafy, and either convolute or variously folded, sometimes fleshy and plano-convex.—Trees or shrubs. Leaves alternate or opposite, exstipulate."

Affinities. These are not easily defined according to DeCandolle, the polypetalous genera approach *Myrtaceae* while the apetalous ones have a closer affinity with *Santalaceae* and *Elaeagneae*, and even with *Laurineae* through *Gyrocarpus*. *Combretum* differs from the rest of the order in having quaternary flowers with 8 stamens, and folded not spirally convolute cotyledons. From *Myrtaceae* and *Onagrarieae* and *Memecyleae*, they differ in their 1-celled ovary and pendulous ovules. From *Santalaceae* and *Elaeagneae* they are distinguished by the foliaceous convolute or plaited, not fleshy cotyledons. This last structure, which separates them from all other orders, allies them with *Gyrocarpeae* which has spirally convolute cotyledons, but from which they are easily distinguished by the longitudinal, not valvular, dehiscence of the cells of the anthers. " The solitary carpel of which the fruit consists is peculiar to these and to *Alangieae*, and neatly distinguishes those two orders from all others of the myrtal alliance" Lind. Upon the whole the weight of authority is in favour of the present station as all those writers who have given much of their attention to natural affinities agree in placing *Combretaceae* among the series of orders with which they are here associated.

GEOGRAPHICAL DISTRIBUTION. As indicated above this is strictly a tropical order and is found within the tropics of Asia, Africa, and America, but not in New Holland. Some of the Indian species however extend considerably beyond the 23° of northern latitude and are even found as far north as the foot of the Himalayas, several are found in the Malayan peninsula and in the Eastern Islands. In the Indian peninsula, though only 9 genera and 19 species are described, the order may be said to abound as most of the species are of frequent occurrence. Those of *Terminalia* and *Conocarpus* abound in the alpine tracts, while *Combretum* and *Getonia* are equally abundant on the plains in those parts of the country where they do occur. *Combretum,* of the two, is more generally diffused. *Getonia* is principally confined to the western coast and about Courtallum, but not limited to these localities.

PROPERTIES AND USES. Most of the species of *Terminalia* are strongly astringent and the bark of several may be used for tanning. The leaf galls and fruit of *T. chebula* are much used by dyers as a mordant for fixing their colours, as well as for imparting, with alum, a durable yellow dye, and with a ferruginous earth an excellent black—Ainslie. The galls are used for making ink, the bark for tanning, they are also employed in medicine when astringents are required, and in short, on all occasions whether in the arts or medicine where astringents are necessary the bark or fruit or galls of *Terminalia* or *Myrobalanus* may be used. Nearly all the species of *Terminalia* and *Conocarpus* are large timber trees and some of them yield very useful timber, but I do not find any precise accounts of their respective qualities. *Terminalia* (Pentaptera) *coriacea* or perhaps *T. glabra* " has a trunk straight and lofty ; wood of considerable diameter, so as to be made into solid wheels for buffalo carts ; strong, hard and heavy" —Berry in Roxb. Fl. Ind. This tree is not mentioned by Ainslie. No useful property is assigned to any of the scandent forms but the wood of *Lumnitzera racemosa* (Petaloma alternifolia, Roxb.) is said to be remarkably strong and durable. The plant is however rare in this part of India and so far as I am aware does not attain a sufficient size to be of much value. Vast quantities of it are daily carried from the Sunderbunds to Calcutta for fuel.

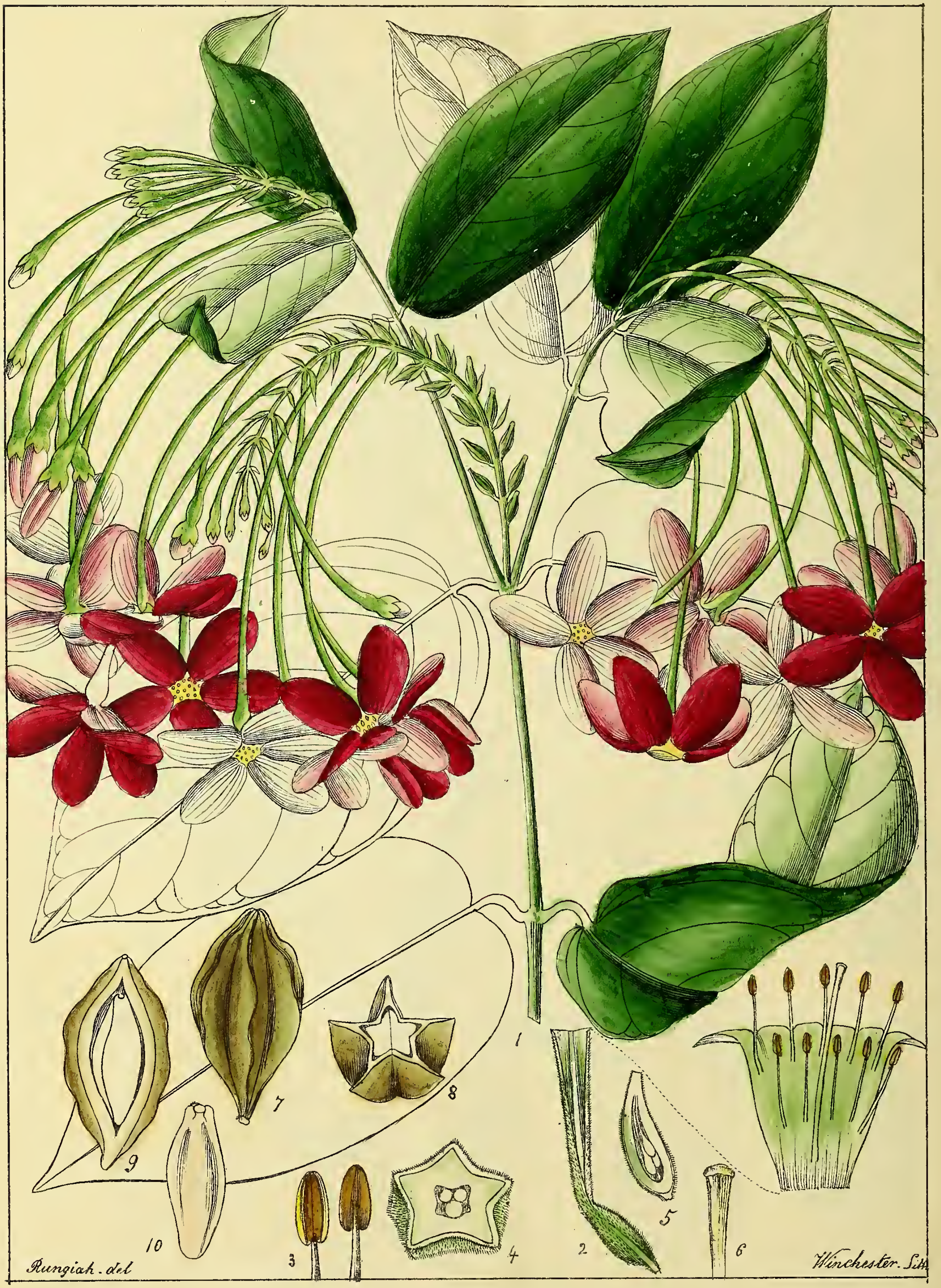
REMARKS ON GENERA AND SPECIES. This order is divided into two tribes *Terminaliae* and *Combreteae.* The former distinguished by its spirally convolute cotyledons and by the petals frequently wanting : in the latter the cotyledons are either thick plano-convex or irregularly and longitudinally plaited, sometimes they are thin and foliaceous or intricately folded. Of the former of these tribes most of the genera are essentially characterized by their flowers, in *Terminalia* the calyx is 5-cleft, the limb small, deciduous, petals none : in *Getonia* the limb of the calyx is large and persistent. From these *Poivrea* and *Lumnitzera* are distinguished by having petals ; the former being separated from the latter by its deciduous, not persistent, limb of the calyx ; and more readily by its habit, which is twining and a native of inland districts while the latter is erect, arboreous, and a native of salt marshes on the coast along with the *Rhizophorae.* *Conocarpus* is readily distinguished from the rest of the order by its capitate apetalous flowers, compressed ovaries and flattened, almost winged, closely imbricating seed ; somewhat resembling a pine cone in miniature whence the name. The Indian species of this genus are all trees natives of alpine districts though rarely found on the highest hills. *Poivrea* is a twining shrub resembling *Combretum,* but separated by its quinary flowers and 10 stamens, not quaternary with 8 stamens, the fruit in both is winged. By far the most conspicuous member of the order on account of the profusion and magnificence of its flowers is the so called Rangoon creeper (*Quisqualis indica*) now so deservedly a favourite in Madras gardens.

Some recent writers the principal of whom are Lamark and DeCandolle has proposed to divide *Terminalia* into 4 genera, taking the characters from the fruit. *Terminalia* is by them restricted to those species with flattened drupes the margins of which are sometimes extended into wings or much attenuated. Those with rounded or obscurely furrowed often fleshy drupes have received from Lamark the name of *Myrobalanus*—a third set characterized by having 5-7, longitudinally, winged fruit, Roxburgh has called *Pentaptera:* while a fourth with 3-5 angled fruit the angles extending into unequal sized wings have received of the name *Chuncoa* (*Gimbernantia,* Ru. & Pav.) both of which genera are adopted by DeCandolle, but he unites *Myrobalanus* and *Terminalia.* The Peninsular flora presents species appertaining to each of these forms.

கடுக்காமரம் Cadoocamarum } Tam

TERMINALIA BELERICA (ROXB.)

కరక్కాయచెట్టు Curraykoychettoo



QUISQUALIS INDICA. (Linn.:)

Conocarpus has in like manner been by Dr. Wallich divided into two genera and apparently on good grounds, namely, the direction of the carpels and the comparative length of the calyx. He limits *Conocarpus* to the American species the tube of the calyx of which is not produced beyond the ovary, and the carpels are retrosely imbricated, not winged: while of the Indian species, which have the calyx produced considerably beyond the ovary and contracted into a slender neck, with the carpels imbricated upwards, winged and crowned by the neck of the calyx he forms the genus *Anogeissus*, from DeCandolle's section of the same name. This innovation is not adopted by Meisner in his genera Plantarum though it has been in the flora Senegambiæ.

EXPLANATION OF PLATE 91.

1. *Terminalia Belerica*, (Roxb.) Flowering branch—*natural size.*
2. A flower, the limb of the calyx to show the insertion of the stamens.
3. An anther after dehiscence.
4. A fruit full grown.
5-6. The same cut transversely and vertically.
7. A seed with the cord, by which it is suspended from the apex of the cell of the nut.
8. The testa removed to show the cotyledons.
9. Cut transversely, to show the cotyledons spirally convolute.

EXPLANATION OF PLATE 92.

1. *Quisqualis indica—natural size.*
2. The ovary and the tube of the calyx opened, to show the insertion of the stamens and its adhesion with the lower portion of the style, the extremity only of the latter being free.
3. Stamens.
4. Ovary cut transversely, 1-celled.
5. Cut vertically, showing three pendulous ovules.
6. Stigma.
7. A full grown fruit.
8-9. The same cut transversely and vertically.
10. The kernel removed from the cell.

LXI.—MEMECYLEÆ.

This is a small order, in Indian Botany limited to one genus, *Memecylon*, a second is found in Cochin-china. It consists of shrubs or small trees, with opposite, simple, entire, often thickish succulent exstipulate leaves, with one central rib and without translucent dots. The flowers are very numerous, small, axillary, pedicelled, sometimes congested in dense capitulæ, occasionally corymbose; usually blue, forming together with the bright shining green leaves most beautiful plants, but strangely enough, no where, that I have seen, introduced into cultivation as ornaments of the shrubbery or flower garden, though met with in every jungle.

" Calyx 4-5-lobed or toothed: the limb striated in the bottom on the inside. Petals 4-5, alternate with the sepals, imbricated into the form of a cone during æstivation. Stamens twice as many as the petals: filaments distinct, in æstivation almost wanting: anthers curved, 2 celled, opening by two short clefts, during æstivation pointing downwards towards the bottom of the limb of the calyx, afterwards by the elongation of the filaments erect: connectivum produced below the cells into a kind of beak. Ovarium 1-celled, coherent with the tube of the calyx: ovules 4-10, erect, seated at the base of the cell: style 1, filiform: stigma simple. Fruit baccate, crowned by the limb of the calyx, usually from abortion, 1-celled Seeds nut-like: often solitary from abortion; erect: testa crustaceous. Albumen none. Radicle curved downwards: cotyledons foliaceous, crumpled and wrapped up, the one round the other, into the form of a little ball. Shrubs. Leaves opposite, simple, entire, without stipules or dots, feather-nerved, or rarely 3-nerved."

Affinities. The affinities of this order are on the one hand with *Myrtaceae* with which they agree in habit, and in their opposite one ribbed leaves, but differ in their leaves wanting pellucid dots, and in their foliaceous convolute cotyledons, and on the other, with *Melastomaceae*, to which they approach in the structure of their anthers and some other points, but differ in the form of the cotyledons and in their one not 3-nerved leaves. Notwithstanding these differences, however, they have recently been by some eminent Botanists united as a sub-order with *Melastomaceae*. How far this union is judicious I am unable to say, not having studied them with sufficient attention to admit of my offering a decided opinion on the subject: though I confess that so far as present information extends I approve of keeping them disinct. I however

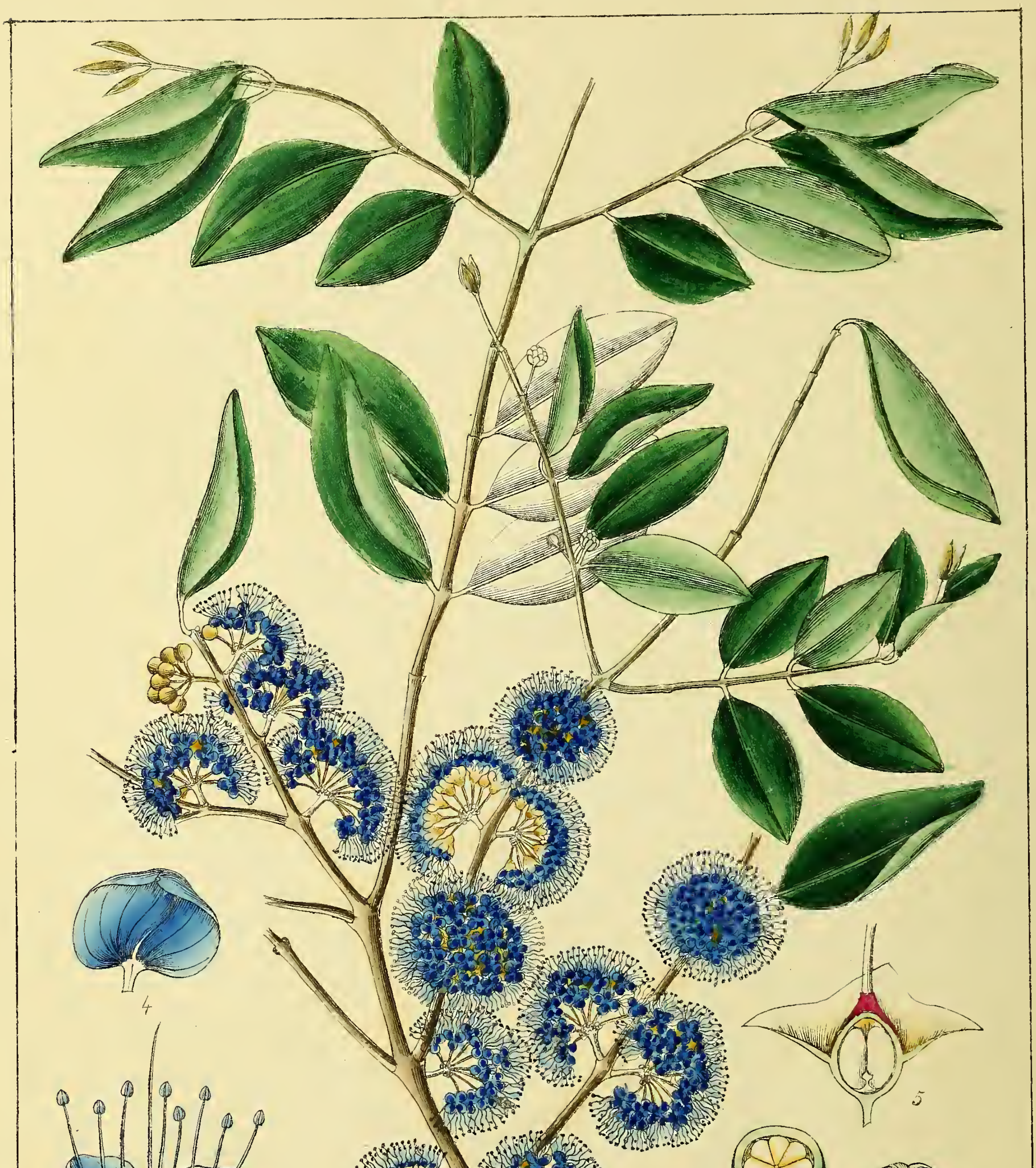
prefer leaving the question as I find it, and follow the track we originally pursued, that of keeping them separate.

Geographical Distribution. Of the whole order only 22 species are described by DeCandolle, about 15 of which are natives of India or of the adjoining Islands, one or two are from Africa, and to these I believe some have since been added: I do not know how many. It is clear however from the great preponderance of Indian species, that this country may be viewed as the head quarters of the order. *Mouriria,* a genus so nearly allied to *Memecylon* that it may be questioned whether it can be kept distinct, is of American origin.

Properties and Uses. Of these little is known. The leaves of *Memecylon tinctorium* and *M. edule,* Roxb. are used in dying, and afford under proper management a very delicate yellow lake, but I have not heard whether the colour is permanent. The berries of most of them are pulpy and have an astringent sweetish taste.

Remarks on Genera and Species. Only one genus is certainly known to exist in India Scutula of *Loureiro,* from Cochin-china, being perhaps the same as *Memecylon. Mouriria* as above remarked, approximates so closely to *Memecylon* that is doubtful whether there is one good character by which to distinguish them, unless we attach considerable value to its geographical distribution, which in the absence of characters derived from structure is scarcely admissible.

The species though few in number are, as they now stand recorded in Botanical works, most difficult of discrimination, so much so indeed, that with a collection of upwards of 100 specimens before me embodying almost every form of inflorescence met within the genus, combined with almost every modification of ovate, oval, and obovate, petioled and sub-sessile leaves, I am unable to fix the limits among the following series, though I find representatives of each among the collection. I will not on this account, go so far as to say that the whole ought to be reduced to one or two species, because, my collection, however complete, may still want some of the forms which are defined as species; but, my enumerating the list, of which I think representatives may be found in my collection of specimens, among which I cannot find certain marks by which to establish only two species, may call attention to the subject and induce persons having opportunities of making collections to give more attention to the subject. Among the series of specimens above alluded to I find representatives of the plants figured by Burman *Thes: Zeylan:* tabs. 30 and 31 by Rheede, Hort. Mal. 5 tab. 19 by Lamark, Illustrations tab. 284 f. 1 and of Roxburgh's *M. edule* Cor. pl. 1 tab. 82. These five plates have by different authors been quoted for *M. capitellatum,* Linn. *M. tinctorium,* Koen. *M. laxiflorum,* D.C., *M. ramiflorum,* Lam. and *M. edule,* Roxb. (Roxb. quotes Burm. Thes: t. 30 *M. capitellatum,* Linn. as a synonym for his plant). To these five may perhaps be added *M. spærocarpum,* D.C. and certainly *M. ovatum* and *M. acuminatum,* Smith. Among all these I think, I can make out only two species, perhaps they are mere varieties. *M. ramiflorum* and *tinctorium* (I believe them the same plant) seems to have a dry berry and oval obtuse or sub-obovate leaves, while *M. edule* has a succulent berry and ovate, bluntly acuminated leaves. The forms of the inflorescence and foliage pass so gradually into each other, that marks taken from them can scarcely be considered good in solitary specimens though in the mass they are useful, and those from the fruit are indifferent herbarium ones as both forms are altered in drying. The inner surface of the calyx affords another mark which I have found pretty constant in the two forms above indicated. In the series corresponding with *M. ramiflorum* and *tinctorium,* the calyx is smooth or nearly so within, while in those corresponding with *M. edule* and *capitellatum* which I think are also one species, there are eight membranous partitions, forming so many open cells in which the anthers previous to dehiscence were lodged, and which remain after the stamens have fallen. These are the eight ribs alluded to by Smith as occurring in his *M. ovatum.* The whole of these species however demand further investigation for their final determination and limitation by precise characters, those hitherto assigned being insufficient for their discrimination. The other Indian species are less difficult. My specimens of *M. cordatum* agree well with both Lamark's figure and description of that species. I have also got additional specimens of *M. Heyneanum* and *M. amplexicaule,* both of which correspond with the characters assigned to them in our



காஷாமரம } MEMECYLON TINCTORIUM (KOEN.:) అల్లూకుచెట్టు }

Cashammarum } Alleyakoochettoo }

Prodromus. In addition to these I have specimens of what appears to me two new species. The one corresponds with DeCandolle's *M. trinerve* in having three nerved leaves, but the branches are quite cylindrical, and the leaves in place of being oval and about two inches long are ovate lanceolate, tapering to a point, and from 6 to 8 inches long. This species is allied to *M. amplexicaule* and *M. Heyneanum*, but I think quite distinct from both. The lateral nerves are marginal. The other species, which approaches *M. ramiflorum* in habit, differs in having long narrow linear lanceolate blunt pointed leaves; about six inches long and scarcely half an inch broad. The inflorescence is so like that of *M. ramiflorum*, that I doubt whether I ought to give it a different name, but the foliage being so very distinct, leaves but little room for hesitation. Three species have now therefore to be added to the Peninsular flora—namely, *M. cordatum* and these two new ones. They may be designated and characterized as follows.

Memecylon cordatum, (Lam.) Leaves sessile or subsessile, broadly ovate-cordate at the base, very obtuse, or rounded at the apex; peduncles axillary, subcapitate or corymbose, branches terete. Lamark Encl. 4 p. 89. Ill t. 284 f. 2.

Hab.—*Malabar.*

The leaves are as broad at the base as they are long, sometimes quite sessile, sometimes furnished with a short petiol.

Memecylon jambosioides, (R. W.) Branches cylindrical, glabrous: leaves ovate, lanceolate, acuminated; 3-nerved: the lateral pair of nerves sub-marginal, united with smaller transverse parallel veins: flowers numerous, forming axillary capituli short pedicelled.

Hab.—*Courtallum in sub-alpine jungles.*

A handsome species. The leaves are almost entirely the same as those of *Jambosa vulgaris* and some of those, on my specimens, are upwards of 10 inches long. The flowers, before expansion, form dense nearly sessile axillary clusters, and the pedicels do not afterwards materially elongate. The fruit is glabrous, polished, judging from preserved specimens, a dry berry.—Seed one, exalbuminous, cotyledons foliaceous, exceedingly convoluted.

Memecylon angustifolium, (R. W.) Branches, terate leaves, confined to the extremities, narrow lanceolate, attenuated below, blunt pointed, one-nerved; peduncles short from the scars of fallen leaves; flowers very numerous, umbellate, or sub-capitate, pedicells small.

Habitat.—*Jungles about Courtallum.*

This species only differs from *M. ramiflorum* in the form of the leaves; in that they are broad in proportion to their length say two inches long by one and half broad, or half that size; while in this, they are from three to four inches long and scarcely half an inch broad, tapering to the petiol below, but blunt pointed. The flowers and inflorescence are the same in both.

EXPLANATION OF PLATE 93.

1. *Memecylon ramiflorum*, (Lam.) *M. tinctorium*, (Koen. W. and A.) Flowering branch—*natural size.*
2. An expanded flower.
3. Stamens, but the anthers very incorrectly represented, oval, dehiscing their whole length in place of cordate, 2-celled above, the base ending in a membranous prolongation of the connective.
4. A petal.
5. The ovary shortly after the fall of the petals cut vertically, showing the ascending ovules.

6-7. A berry very immature cut transversely, to show the numerous seed.

LXII.—MELASTOMACEÆ.

A vast tropical order, containing according to Meisner's list, 100 genera, excluding four of *Memecyleae*, which he considers a tribe only of *Melastomaceae* and not a distinct order. This union of these two families is, it appears to me, scarcely authorized by the character of the flowers, and is not supported by the fruit and seed which differ greatly in the two orders. According to DeCandolle's enumeration there are about 800 species, which number, I believe, has been very considerably augmented since the publication of his work. Of that number 620 are from America leaving a comparatively small number for Asia, Africa, and New Holland.

In our Prodromus 15 species only are described, a number which my more recent excursions have not materially extended, though they have afforded ample evidence of the difficulty of distinguishing the species of this order, through their tendency to vary their forms. I find for example on comparing many very dissimilar looking specimens, no good marks by which to distinguish them as species. A more intimate acquaintance, however, with growing plants may perhaps furnish us with characters by which to augment the number. In some parts of this

country, and also in Ceylon, they are very abundant, and many of them most magnificent and showy plants.

The species are either trees, shrubs, or herbaceous plants, with opposite, exstipulate, entire leaves; usually without pellucid dots and marked by three or more thick longitudinal nerves or ribs. The flowers are usually bi-sexual, regular, often panicled, rarely solitary, the panicles or cymes usually contracted. The most remarkable peculiarity of this order is the position of the stamens in æstivation. The filaments are inserted near the orifice of the calyx, and the anthers are bent down into its tube, occupying the vacant space between it and the ovary, after the expansion of the flower they ascend. A somewhat similar arrangement is observable in *Memecyleae* with this difference, that the ovary is there altogether inferior and the anthers fill the cup of the calyx. The relative position of the ovary in the two orders generally affords a good discriminating mark between them, but is not always to be depended on as some *Melastomaceae* resemble *Memecylon* in this respect.

" Calyx with 3-5 teeth or divisions, which are more or less deep, or are sometimes united and separated from the tube like a lid. Petals equal to a segment of the calyx, perigynous, twisted in æstivation. Stamens either equal in number to the petals and alternate with them, or usually twice as many, the alternate ones of a different shape and perhaps never with fertile pollen: filaments in æstivation, bent downwards towards the bottom of the calyx: anthers long, 2-celled, bursting usually by one or two terminal pores, rarely longitudinally. Ovarium with several cells, rarely completely combined with the tube of the calyx, very rarely entirely free from it, usually cohering with it more or less by means of 3-10 longitudinal nerves, thus forming as many cases as the anthers which they contain during æstivation: ovules indefinite: style 1: stigma simple, entire, capitate or reduced to a mere point. Placentæ in the axis. Fruit pluri-locular: either free and then capsular, valvate and loculicide; or adherent, baccate (a balausta), and indehiscent. Seeds numerous, minute. Albumen none. Embryo straight or curved: radicle pointing to the hilum: cotyledons equal or unequal.—Leaves opposite, undivided, not dotted, 3-9-nerved."

Affinities. My acquaintance with this very extensive order being slight, and my means of extending it very limited, I refrain from attempting to offer any opinion of my own on this head, but that this article may not be, by so much, deficient I shall introduce the whole of the valuable remarks of Dr. Lindley on their affinities for the benefit of those of my readers who may not have an opportunity of consulting the original.

" The family of *Melastomaceae*" remarks DeCandolle, in an excellent memoir upon the subject, " although composed entirely of exotic plants, and established at a period when but few species were known, is so well characterized, that no one has ever thought of putting any part of it in any other group, or even introducing into it genera that do not rightly belong to it." These distinct characters are, the opposite leaves, with several great veins or ribs running from the base to the apex, something as in Monocotyledonos plants, and the long beaked anthers; to which peculiarities combined there is nothing to be compared in other families. Permanent, however, as these characters undoubtedly are, yet the cause of no uncertainty having been yet found in fixing the limits of the order, is rather to be attributed to the small number of species that have been examined, than to the want of connecting links: thus *Diplogenea* has traces of the dots of *Myrtaceae*, which were not known to exist in *Melastomaceae* until that genus was described; several genera are now described with a superior ovary, a structure which was at one time supposed not to exist in the order; and, finally, in the remarkable genus *Sonerila*, the leaves are sometimes not ribbed.

The greatest affinity of *Melastomaceae* is on the one hand with *Lythraceae*, on the other with *Myrtaceae* and their allies; from the former they differ in the æstivation of their calyx not being valvate, from the latter in having the petals twisted before expansion and no dots on the leaves, and from both, and all others to which they can be compared, in their long anthers bent down parallel to the filaments in the flower, and lying in niches between the calyx and ovary; with the exception of *Memecylaceae*, in which, however, the union between the calyx and ovary is complete, and which have leaves destitute of the lateral ribs that so strongly point out *Melastomaceae*. The structure of the seeds of *Memecylaceae* is also different.

GEOGRAPHICAL DISTRIBUTION. As stated above, America may justly be considered the head quarters of this tribe, upwards of 600 species having been obtained from that quarter out of about 800 described by DeCandolle in his Prodromus. Since the publication of that work many genera and species have been added, whence I believe I under estimated the number of species now known at one thousand. Of this number probably about 100 are natives of continental India and Ceylon; of these Roxburgh seems only to have known 14, as 7 out of 21 described by him are from Pulo Penang and the Moluccas. Blume has added largely to the list from Java, having probably nearly doubled the Indian list, that is, supposing that the other genera are somewhat in proportion to *Medinilla,* of which that Island produces 21 species. In Ceylon *Melastomaceae* are also numerous, and several new and very curious species have recently, through the researches of Colonel Walker, been brought to light; among these are several species of *Osbeckia,* five or six of *Sonerila* and three or four of *Medinilla.* One species of this last genus, but differing somewhat from the generic character especially in the anthers being spurred only, not auricled and spurred, at the base, is among the handsomest plants I have ever seen. It is an enormous creeper, adheres firmly to the trees on which it grows, climbs to the tops of the highest trees of the forest, and covers them with a profusion of large crimson flowers. This species I first saw in company with Colonel Walker (in a dense forest above Ramboddy) to whom I have dedicated this noble plant *Medinilla ? Walkerii.* On the alpine ranges of the southern provinces and in Malabar, I collected many specimens, several of which, I then supposed were new species, but which, on a more careful examination and comparison with others, must I fear be considered as varieties only, at least I have not yet been able to find satisfactory distinctive marks by which to raise them to the rank of species. Figures of some of these shall shortly appear in the Icones. In addition to these from the south, a few species spread northwards and even extend to the foot of the Himalayas, but these are so few in number as scarcely to form an exception to the general rule that this is truly a pre-eminently tropical order.

PROPERTIES AND USES. Astringency is said to be the predominating quality of the order, but little seems yet known regarding them. Lindley remarks that the order " though one of the most extensive known is entirely destitute of any unwholesome species. The succulent fruit of many is eatable that of some dyes the mouth black, whence the name *Melastoma.* It may be here remarked as somewhat curious that the genus established by Burman under this name, for which he is quoted as the authority and of which he figured two species, is not that now called *Melastoma,* but *Osbeckia,* the original name being limited to a genus, of which it does not appear he ever saw a single plant.

REMARKS ON GENERA AND SPECIES. The Indian genera are few and easily distinguished, I do not therefore think it necessary to devote much space to this division. *Osbeckia* has either a quaternary or quinary order but the stamens are all alike. *Melastoma,* which in general appearance it resembles is easily distinguished by the stamens, one-half having the anthers sessile on the apex of the filament, the other having them supported on a long pedicel or stipe, apparently formed from a prolongation downwards of the connectivum: by this mark alone these allied genera can always be distinguished at a glance. *Sonerilla* is separated from both by its ternary order of parts—*Medinilla* has a quaternary series, the anthers with auricles and a spur at the base, in M. *Walkerii* the auricles are wanting, but the spur is considerable, on which account I have marked the genus with a doubt. Among my collection of Mergui plants communicated by Mr. Griffith I find a second species presenting the same peculiarity, agreeing in that respect with *Pternandra,* but distinguished by the anthers of the latter opening by a longitudinal slit not by a pore as in the other. The genus *Triplectrum* abounds about Courtallum but seems rarely to flower as I, in the course of several visits to that place, could not find a single plant in flower though I walked over acres of ground covered with the plant. This disappointment I the more regretted, as the genus is founded on a single specimen and that not a very good one, whence I fear it may only be a modified state of *Medinilla.*

As above remarked I have found but few new species, but have seen great reason to believe that those already described are apt to vary so considerably, as to lead to the supposition of their being distinct when separately examined, though when numerous specimens are compared at the same time, the differences, which in extreme forms might appear so considerable as not to admit of union, are yet found gradually to meet through the medium of intermediate forms. Dr. Arnott in a paper on the Ceylon *Melastomaceae* published in the Companion to the Botanical Magazine has defined several new ones, the abridged differential characters of which I subjoin, though I do not feel quite certain that they are all distinct.

SONERILA.

1. *S. Ceylanica;* branches glabrous, anthers cordate-ovate, obtuse.
2. *S. affinis;* branches nearly glabrous, anthers cordate-oblong, attenuated, style filiform, stigma capitate.
3. *S. glaberrima;* branches and leaves glabrous, anthers lanceolate, acuminated, style thickened in the middle, stigma minute.
4. *S. hirsutula;* stem herbaceous, branches hirsute, petals ovate, acuminated, anthers lanceolate-subulate.
5. *S. Wightiana;* stem herbaceous, branches hirsute, anthers linear-lanceolate, obtuse, stigma minute.
6. *S. Hookeriana;* stem somewhat woody, branches clothed with reddish short wool, anthers cordate-ovate, obtuse, stigma capitate.
7. *S. robusta;* stem somewhat woody, branches covered with close spreading hairs, petals broadly oval, acute, anthers lanceolate-subulate.

OSBECKIA.

Anthers 8.

1. *O. Ceylanica;* annual, anthers subulate.
2. *O. truncata;* branches hirsute, leaves one inch to one inch and a quarter long, anthers truncated.
3. *O. parvifolia;* branches nearly glabrous, leaves three to four lines long, anthers truncated.

Anthers 10, acuminated.

Leaves crowded.

4. *O. buxifolia;* leaves thick and rigid, closely straited.

Leaves rather distant.

5. *O. rubicunda;* leaves on rather long petioles, scales of the calyx spreading, reddish, style clavate.
6. *O. Wightiana;* leaves nearly sessile, scales of the calyx adpressed, yellowish, style clavate.
7. *O. virgata;* leaves at length nearly glabrous on the upper side, flowers somewhat umbelled, style filiform.
8. *O. aspera;* branches strigose, upper side of the leaves copiously covered with adpressed bristles, under hirsute on the nerves, and harshly pubescent between them, flowers somewhat racemose, style filiform.
9. *O. Kleinii;* branches scabrous or hispid, leaves minutely strigose on both sides, flowers shortly racemose, style filiform.
10. *O. Walkeri;* branches shortly tomentose, flowers terminal, solitary, calycine segments elongated; style filiform.

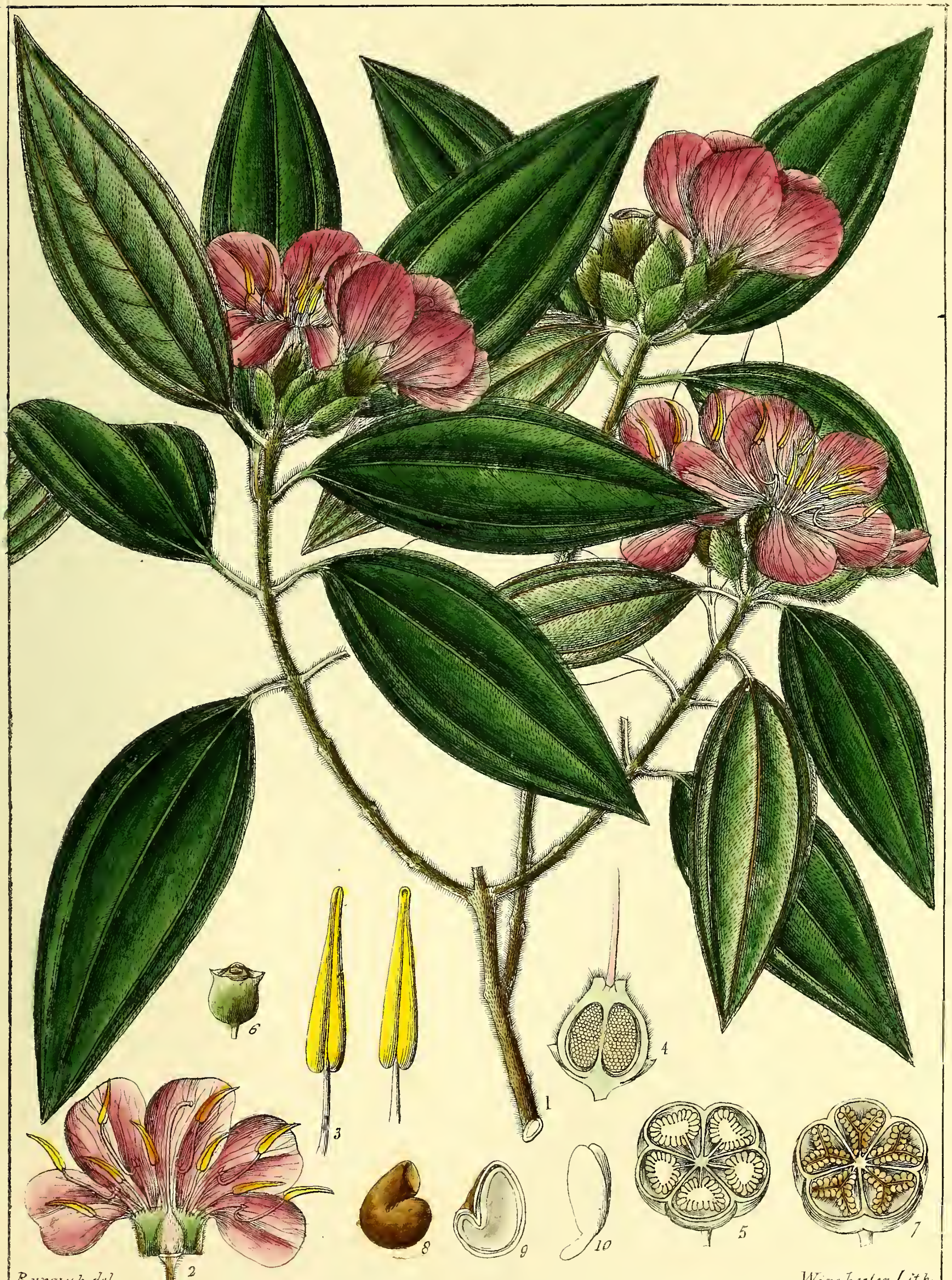
EXPLANATION OF PLATE 94.

1. *Sonerila brunones—natural size.*
2. A dissected flower, showing the inferior ovary.
3. The ovary cut vertically, many-seeded.
4. Cut transversely, 3-celled, with a triangular central placentæ and several rows of ovules in each cell.
5. A seed nearly mature.
6. A cluster of capsules—*natural size.*
7. One of them magnified.

EXPLANATION OF PLATE 95.

1. *Melastoma malabathricum—natural size.*
2. A dissected flower, the tube of the calyx divided and forcibly opened to show the insertion of the petals and stamens and the free ovary.
3. Stamens, the larger one unfortunately imperfectly represented as not showing the downward elongation of the connectivum, the character by which this genus is essentially separated from *Osbeckia.*
4. The ovary cut vertically.
5. Cut transversely.
6. A young fruit.
7. The same cut transversely, the appearance of the interior somewhat altered by drying. The dissections having been made from dried specimens.
8. A seed.
9. The same cut vertically.
10. The cotyledons and radicle removed from the testa.

SONERILA BRUNONIS (W & A)



MELASTOMA MALABATHRICUM (Linn)

PROSPECTUS.

PREPARING FOR PUBLICATION

In Monthly Numbers of Ten Plates each, price One Rupee, printed uniform with the Illustrations of Indian Botany.

ICONES PLANTARUM INDIÆ ORIENTALIS,

OR

FIGURES OF INDIAN PLANTS,

DESCRIBED IN THE AUTHOR'S

PRODROMUS FLORÆ PENINSULÆ INDIÆ ORIENTALIS ;

AND IN HIS

ILLUSTRATIONS OF INDIAN BOTANY.

NO. I. TO APPEAR IN JULY.

Almost before the 1st Number of my " Illustrations" had issued from the press, I had become sensible, that the number of plates, which the plan of that work admitted, was inadequate for the attainment of one of its principal objects, the full elucidation, namely, of the distinctive characters of the natural orders as explained in the descriptive portion of the work ; much of which, in consequence, remains to many, almost a sealed book, from the examples I am obliged to quote in illustration of my meaning, being often unknown to the reader. To go no further than the accompanying number I may refer to the description of Capparideæ, where several examples are quoted in support of particular statements, such as Cadaba, Gynandropsis, Polanesia, &c., not one of which, though all most common plants, may be known to the majority of readers, and to such therefore can afford but little assistance towards acquiring a correct knowledge of the peculiarities they are intended to explain. This information I am desirous of communicating through the aid of additional figures. Again when treating of " Properties and Uses" of plants, many are mentioned as meriting attention on account of properties, they are known to possess, but of whose forms the name communicates no definite idea. Thus under Dilleniaceæ, both Dillenia speciosa and Wormia Madagascariensis are mentioned as desirable additions to the ornamental shrubbery, but whom, of the many persons who may have read these encomiums, who have never seen either the plants themselves, or a figure, can form a just conception of their fitness for the purpose indicated. Almost every order treated of, affords similar examples, and many of them most common plants. In conversation plants are often spoken of, as endowed with valuable properties, but about which we may remain as much in ignorance as before, however common the plant, if we happen not to know the name, and have no figure to consult on the occasion. To supply such a book of reference is another object of these figures. For want of figures Dr. Ainslie's Materia Medica of Hindoostan, to compile which cost him nearly 20 years of incessant application and research, remains to this day, little better than a monument of abortive labour, so few persons of the many in this country who consult it, possessing sufficient acquaintance with the plants named, to be able to recognise them even when laid before them, and fewer still, to go in search of them when wanted. Hence, of nearly 500 species of plants named in that work, as used for medicine, food, or in the arts, scarcely one-tenth are known to Europeans, and perhaps not more than a third to Natives generally, and of which non-Botanical readers have no other means of acquiring a knowledge, than through the oral communications of natives, whose acquaintance with the plants indicated, being entirely traditional, without any guide to direct them always to the same plant, is often, as likely to be wrong as right. This is no imaginary statement, it is one, the truth of which I have seen verified in a thousand instances. Another, and not the least important purpose of these figures therefore is, to give a value to that work, by making known through correct delineations, the plants meant by the Author, and at the same time, to establish the Native names, of at least so many of our indigenous plants, on a firm basis, by combining them with representations of the objects named. Such a work still remains an important desideratum to all classes of the community.

To attempt all this by the publication of Coloured Plates, would only tend to defeat my object, since the heavy cost, and great length of time required to colour each plate separately, after printing, by the hand would perhaps greatly abridge the usefulness of the work, as well by retarding its progress, as by limiting its circulation to the wealthier classes. My wish is to diffuse as quickly, and as extensively as possible, a knowledge of Indian Plants, by publishing as many as possible in the shortest period of time, and at the lowest charge. To attain these objects, the figures will be prepared in the style adopted in the accompanying specimens, two of which are copies of plates already published in the Illustrations, and the other two copied from copper plate engravings. The first were selected to admit of comparison with the originals, to enable those who contemplate supporting the work to judge, how far such figures are fitted to supply the place of coloured ones in communicating a knowledge of the plant represented. Still further to reduce cost, and increase the rapidity of publication, it is not my intention to give letter-press descriptions, but refer for these to my Prodromus, by numbering the plates uniform with the running numbers of that work, except in cases where new plants, are introduced; and then their place in the arrangement will be indicated by a double number, and a description given, printed in such a form, as to admit of its being either pasted on the back of the plate, or kept separate. For such descriptions no additional charge will be made. By the adoption of this plan, these figures will form, so far as they go, a *Pictorial Index* to the Prodromus and to the new species described in my Illustrations of Indian Botany. Utility and an

anxious desire of making known, as many Indian plants as possible, being my principal inducement for undertaking this work, I shall consider it open to the contributions of those who may feel desirous of assisting me by communicating good figures of interesting plants, (if accompanied by specimens to enable me to verify their correctness) all of which shall be duly acknowledged. Occasionally also, when unable to procure specimens from which to prepare original drawings, I shall consider myself at liberty to select from rare and costly works now little known and seldom met with in this country, figures of useful plants. Among the works alluded to, may be mentioned the magnificent ones of Rheede, Roxburgh, and Wallich, the latter of whom, has obligingly permitted me to select from his publications, whatever I may think useful for this one. The plants mentioned in Ainslie's Materia Medica will of course occupy a prominent place, first as more especially appertaining to the Economical Botany of the Peninsula (they will always be accompanied by his names) and secondly because I hold it to be a matter of primary importance, to make known, as many as possible of the plants referred to in a work so generally known and consulted as that is in India.

The grand object of this work may now be summed up in few words, viz. *to give to India*, (so far as the limited resources of a private individual will permit) *that which England has so long enjoyed, in " Smith's English Botany," a standard Botanical Book of reference* ; by the publication of correct figures, of as many Indian Plants as I possibly can and in the shortest period of time.

The publication of 120 figures per annum is scarcely sufficient to meet my own wishes in that respect, but it is the utmost I can venture to promise at the outset. Should however adequate encouragement be extended to the work, I shall endeavour to increase its speed, by augmenting the number of plates to 15 or more, in each monthly number, but at the same rate of charge (10 per rupee) which is considerably below the English cost of plates of a similar description.

As a proof that others as well as myself have felt the want of such a work, and duly appreciate the advantages to be derived from it, I subjoin an anonymous letter, received while engaged in drawing up this Prospectus. The author has certainly misunderstood the object of the Illustrations which, as I stated in the Prospectus to that work, is simply to supply the Indian Botanical amateur with the means of acquiring a knowledge of the Principles of the natural method of Botanical classification, by presenting him with a series of diagrams of the organs from which the characters of the orders are taken, to enable him to compare them with the written characters. As however the views of the author are strictly in accordance with my own, in regard to the necessity that exists for this work, I gladly avail myself of their support on the present occasion.

Sir,—Permit me as an admirer of your Illustrations of Indian Botany to suggest an alteration in its plan, which will I think be a decided improvement.

Your present design is I conceive much too limited, and the work, though useful as far as it goes, is not comprehensive enough to form a sound and standard work on Botany.

Your " Prodromus" when completed, is intended I believe to form an entire dictionary, so to speak, of Indian Botany, comprehending *every* species of the vegetable kingdom, which has come under your observation, either in a state of nature or preserved in collections. Allow me then to suggest, that your Pictorial Illustrations should form a part of this work, that *every* species in the Prodromus should be delineated in the other, and that instead of the long descriptions you have given, a simple reference should be made to the Prodromus, *with the addition* of such remarks as you might think necessary.

You may probably object to my design on account of its magnitude, and of the length of time it would occupy. The former of these objections, is scarcely admissible when the work is so divided as to allow but a small part of the labor to press upon you at a time. The latter is answered by its extended usefulness.

You may urge that many purchase your Illustrations who are not in possession of your Prodromus, but I believe you have only to tell them to buy it.

Should you think of considering my suggestion, you might begin to publish a series of intermediate numbers, numbered No. 1. *a.*—1. *b.* and so on.

I cannot help thinking that your present plan is too limited, and beg to subscribe myself.

Your admirer,
X Y Z.

To Robert Wight, *Esq.*
Madras.

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DILLENIA SPECIOSA. (*Thunb.*)

SYALITA (*Rhede*)

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